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# Making Change With Mathematics: Youth Conceptions of the Role of Mathematics in Citizenship

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# Making Change With Mathematics: Youth Conceptions of the Role of Mathematics in Citizenship

## **Abstract**

This study analyzes the relationship between youths' conceptions of citizenship and their conceptions of mathematics in order to understand the role that mathematics can play in the development of youth as citizens. The study also explored the possibilities and challenges of a social justice mathematics approach in the development of youth as citizens. Individual interviews were conducted with a total of 38 students from two research settings: a middle-school mathematics class in a public school in a low-income neighborhood serving primarily Black youth, and a mathematics class at an alternative educational program for out-of-school youth obtaining their GED serving primarily a low-income Latino population. An analysis of students' conceptions of citizenship using Westheimer and Kahne (2004)'s framework highlighted the prevalence of personally responsible conceptions of citizenship across both settings. Having students discuss issues in their communities prompted students to also suggest participatory actions, and engaging in discussions about issues of injustice specifically yielded justice-oriented responses. Personally responsible responses and even participatory responses were often coupled with a sense of powerlessness, as they focused on addressing symptoms of issues by changing or controlling individuals' behaviors. Students' conceptions of mathematics also reflected personally responsible conceptions of citizenship. Examining students' conceptions of mathematics revealed that students have a limited perspective of the role of mathematics in the world, such as in applications involving money, daily tasks, and careers. Students from both settings, but especially those from the alternative education program, also expressed that the mathematics they learn in school primarily serves a credentialing role. Mathematics for social justice offers a promising means to empower youth as justice-oriented citizens by showing them how mathematics can play a key role in learning about and making change in the world. In their reflections about mathematics for social justice lessons, students expressed that mathematics validated their experiences and provided powerful evidence to use in pressing authorities to listen to their issues.

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MAKING CHANGE WITH MATHEMATICS:  
YOUTH CONCEPTIONS OF THE ROLE OF MATHEMATICS IN CITIZENSHIP

Vivian Yuheun Lim

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MAKING CHANGE WITH MATHEMATICS: YOUTH CONCEPTIONS OF THE  
ROLE OF MATHEMATICS IN CITIZENSHIP

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Vivian Yuheun Lim

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## ABSTRACT

### **MAKING CHANGE WITH MATHEMATICS: YOUTH CONCEPTIONS OF THE ROLE OF MATHEMATICS IN CITIZENSHIP**

Vivian Lim

Janine Remillard

This study analyzes the relationship between youths' conceptions of citizenship and their conceptions of mathematics in order to understand the role that mathematics can play in the development of youth as citizens. The study also explored the possibilities and challenges of a social justice mathematics approach in the development of youth as citizens. Individual interviews were conducted with a total of 38 students from two research settings: a middle-school mathematics class in a public school in a low-income neighborhood serving primarily Black youth, and a mathematics class at an alternative educational program for out-of-school youth obtaining their GED serving primarily a low-income Latino population. An analysis of students' conceptions of citizenship using Westheimer and Kahne (2004)'s framework highlighted the prevalence of personally responsible conceptions of citizenship across both settings. Having students discuss issues in their communities prompted students to also suggest participatory actions, and engaging in discussions about issues of injustice specifically yielded justice-oriented responses. Personally responsible responses and even participatory responses were often coupled with a sense of powerlessness, as they focused on addressing symptoms of issues

by changing or controlling individuals' behaviors. Students' conceptions of mathematics also reflected personally responsible conceptions of citizenship. Examining students' conceptions of mathematics revealed that students have a limited perspective of the role of mathematics in the world, such as in applications involving money, daily tasks, and careers. Students from both settings, but especially those from the alternative education program, also expressed that the mathematics they learn in school primarily serves a credentialing role. Mathematics for social justice offers a promising means to empower youth as justice-oriented citizens by showing them how mathematics can play a key role in learning about and making change in the world. In their reflections about mathematics for social justice lessons, students expressed that mathematics validated their experiences and provided powerful evidence to use in pressing authorities to listen to their issues.

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## CHAPTER 1: INTRODUCTION

Let me claim that it is misleading to see mathematics education primarily as something that prepares for a job. Instead it should be looked upon as something that prepares for full citizenship, for the exercise of all the rights and the performance of all the duties associated with citizenship in a critical and conscious way. (D'Ambrosio, 1990, p. 21)

A strong mathematics education is often cited to be a crucial component for participation in society. Moses and Cobb (2001), for example, declare it an issue of civil rights that individuals have access to a quality mathematics education because higher mathematical skills are necessary for individuals to be competitive in a technical and global economy. What is missing from the rhetoric is how mathematics education can support citizens to participate in a democracy—to develop the capacities and power to engage meaningfully in a social and political sense, to impact their society as everyday citizens (D'Ambrosio, 1990, Winslow, 1998). If the mission of schools is to educate and empower youth to fulfill their role as citizens of society, then it is important to understand how mathematics education can shape students' development as citizens. Although mathematics education is not typically associated with citizenship development as opposed to a subject like social studies, mathematics education can and does play a crucial role in aiding the development of capabilities necessary for participation in a democracy, on both explicit and implicit levels. Experiences learning mathematics inside the classroom can teach students about how mathematics relates to the social and political world and also how students are positioned inside that world (Skovsmose, 1990; Mukhopadhyay, 2009).

This study examines youth's conceptions of citizenship and mathematics to understand how they understand what it means to be a citizen and the role mathematics

plays in citizenship. In other words, studying youth's conceptions can illuminate whether and how the mathematics students learn in school contributes to their ideas of what it means to be a citizen and to their abilities to enact these ideas. Educating for citizenship is especially pressing for youth of color and of lower socioeconomic status, who have been found to have fewer civic education opportunities in schools (Kahne & Middaugh, 2008; Levine & Flanagan, 2010). My research examines the conceptions of mathematics and citizenship of youths in two different settings in an urban city: a neighborhood, public middle school in a predominantly African American neighborhood, and an alternative educational program for youth who dropped out of high school in a predominantly Latino neighborhood. While the youths at both of these settings belong to underserved populations, their differences in age, experience, and background provide an opportunity to explore how youth in distinct positions with respect to formal schooling and engagement with society in the real world view citizenship and its relationship with mathematics differently.

The aims of my research were twofold. First, I sought to understand how the youths in the two settings conceptualized citizenship, mathematics, and the relationship between mathematics and citizenship. Second, I sought to explore the possibilities and challenges of a social justice mathematics education approach in influencing students' conceptions. I collaborated with two teachers, one from each setting, to develop and implement curriculum engaging their students in mathematics lessons examining issues of injustice pertinent to the students' lives and communities. The students' reflections about these lessons across the two settings reveal how their particular experiences



interacted with their conceptions of mathematics, citizenship, and the role of mathematics in citizenship.

### **Statement of the Problem**

Studying the civic development of youth has strong relevance during a time of rising concerns over civic disengagement. In *Bowling Alone*, Robert Putnam (2000) famously laments the disintegration of Americans' social connections as they increasingly disengage from participation in political, community, voluntary, and other social organizations. In doing so, he articulates a general concern over the decline of civic and political engagement in this nation. A focus of this concern is the development of youth as citizens. According to Levine and Flanagan (2010), the years that individuals spend in their youth constitute a "formative period when civic values and political ideologies crystallize," and they claim that youth encountering opportunities to engage in activities that nurture their civic development will influence their likelihood to do so in the future (p. 163). Yet studies have shown that youth are disengaged from the political arena (Niemi & Junn, 1998), have low voting rates (Donovan, Lopez, & Sagoff, 2005), and are less interested in politics and public issues than previous generations (Carnegie, 2003). These results are concerning, as youth are viewed as bearing the responsibility to continue and advance our democratic society. The Education Commission of the States (2000) states urgently, "If we do nothing to improve how students are educated for citizenship, we give up the ability to set the terms for the future of our children and, in the end, the nation" (p. 8).

In response, educational organizations have declared the important role that schools must play in the civic and political development of youth. In 2003, the Carnegie

Corporation of New York partnered with the Center for Information and Research on Civic Learning and Engagement (CIRCLE) to publish *The Civic Mission of Schools*, a document declaring the need for “a richer, more comprehensive approach to civic education in the United States” that involves both curricular and extracurricular aspects of schooling (p. 4). In the document, the authors point to the fact that the original mission of public schooling was to educate students to become literate and capable in participating as citizens of a democratic society. In addition, they claim that because schools are equipped to advance students’ cognitive development, operate as a community, and are accessible (and mandatory) for all students, they are the ideal institutions for the civic education of youth. The importance of civic education is also reflected in the inclusion of civic education outcomes in the National Assessment of Educational Progress (NAEP), a national survey mandated by U.S. Congress measuring student academic achievement in various subjects that is otherwise known as “The Nation’s Report Card.” The NAEP has been assessing civics since 1969 and most recently did so in 2010.

Despite these efforts, civic education has not fared well. The NAEP survey from 1988 showed that students’ knowledge of civics was superficial and declining compared to previous years, and the most recent 2010 report shows almost no improvement or a decline in the middle and high school years (Weiss, Lutkus, Grigg, & Niemi, 2001; National Center for Education Statistics, 2011). Other studies have shown that civics is often relegated to low status and priority in the curriculum of schools. An international study of civics conducted through the International Association for the Evaluation of Educational Achievement (IEA) found that civic-related courses and extracurricular

activities have decreased as schools are pressured to meet the demands of achievement on high-stakes tests in subjects like mathematics and reading (Amadeo, Torney-Purta, Husfeldt, & Nokolova, 2002).

The opportunities for civic development are even fewer for socioeconomically disadvantaged youth and youth of color. According to NAEP results, youth of color and youth from poor neighborhoods score lower on exams of civic knowledge than their White and affluent suburban counterparts (Weiss et al., 2001). Hart and Atkins (2002) point to a lower quality of education for these populations in general as a factor for this difference, while Kahne and Middaugh (2008) pinpoint the gap in specific school-based opportunities. In their survey study of high-school aged students from California, Kahne and Middaugh (2008) found that African American students are less likely than White students to have had courses related to government, discussions about current events and other social issues, and to have engaged in experiences such as decision-making and simulations of civic processes; meanwhile, Latino students were found to be less likely to have had opportunities to engage in community service, simulations of civic processes, or even open classroom climates in general. They also found that based on both individual and school level measures of socioeconomic status (SES), higher SES was associated with a higher likelihood of having civic development opportunities in their schools. These disadvantages are significant, as citizens of low-income and citizens of color are underrepresented in political processes in the United States (Kahne & Middaugh, 2008). The implications for providing civic education is important for all youth, but it is particularly important for socioeconomically disadvantaged youth and youth of color for the purpose of equity and justice.

What these studies fail to consider, however, are what constitutes civic engagement and what it means to be a citizen. In other words, what does citizenship mean for youth, particularly for marginalized youth? There are multiple ways to conceptualize what it means to be a citizen (e.g., Westheimer & Kahne, 2004). An understanding of the particular conceptions that youth hold is essential if schools are to meet the charge of educating and empowering them as citizens.

A second question is what role can and does mathematics education play in developing citizens? If schools are to support democratic citizenship, then the value of mathematics education in developing citizenship must be considered. However, mathematics has primarily been positioned in the role of supporting economic aspects of citizenship. In addition to Moses and Cobb (2001)'s declaration of mathematics education as a civil right for participation in a modern economy, mathematics education has been cast as a key to the economic prosperity of the nation. In 2009, United States President Barack Obama launched his Educate to Innovate initiative to bolster education in Science, Technology, Engineering and Mathematics (STEM) with the goal to educate "an informed citizenry in an era where many of the problems we face as a nation are, at root, scientific problems" (The White House, United States Government, 2009). Under the Educate to Innovate initiative, the White House holds an annual science fair, and it has helped launch Change the Equation, a non-profit established in partnership with business executives that facilitates business participation in supporting STEM education. These efforts indicate a focus on supporting the work of scientists and innovators as well as on building a capable workforce. In fact, the mission statement for Change the Equation reads: "STEM literacy opens doors to employment in every industry, sector,

and profession, not just in traditional STEM fields – from entry-level jobs that require a certificate or associate's degree to jobs in the C-Suite” (Change the Equation, 2016). In terms of citizenship, mathematics education has been limited to ways in which it can increase economic participation and drive innovation as a way to engage with society and solve its problems. What is missing and what this study focuses on is the role of mathematics in empowering all citizens, not just innovators, as problem solvers in society, as critical participants in social and political life. The following section outlines frameworks for understanding the relationship between mathematics education and the development of citizens.

### **Theoretical Framework: Mathematics Education and the Development of Citizens**

There have been two main ways that the relationship between mathematics and citizenship is discussed in the literature: 1) mathematics education for building the quantitative literacy needed to navigate and participate in civic life, and 2) mathematics as a tool or framework for students to engage in critically understanding and acting in the world. These categories align with Apple (1992)’s distinction between functional and critical mathematical literacy. According to Apple, different definitions of literacy reflect different “cultural visions and differential power over schooling” (p. 423). On the one hand, functional literacy depends on accepting the dominant cultural visions such that citizens could navigate and conform to these visions. On the other hand, the goal of critical literacy is to upset the dominant cultural visions by questioning and challenging them towards achieving “a more democratic culture, economy, and polity” (p. 423). Thus, different ideas about the role of mathematics reflect different ideas about citizenship, and they consequently have different implications for implementing

mathematics in the classroom. This section elaborates on these distinctions and asserts the theoretical framework being employed in this study.

### **Mathematics Education for Functional Citizenship**

Coupled with reading, mathematics has often been touted as fostering an essential skill for students to learn in order to be able to navigate society. In conversations about citizenship, the aspect of mathematics that is often highlighted is the set of skills necessary for quantitative literacy, an important component of functional literacy overall. In 1980, the National Council of Teachers of Mathematics (NCTM) published *An Agenda for Action*, which heralded its vision for mathematics for the United States in modern times. In the document, the NCTM defines quantitative literacy as necessary to not only perform the computations needed in real-life situations but also to recognize which computations would be needed under different circumstances, declaring that someone without these skills “has not entered the mainstream of functional citizenship.”

Moses (Silva & Moses, 1990; Moses & Cobb, 2001) extends the idea of mathematics for access to participation in society beyond basic mathematics skills. He argues that mathematics literacy includes more advanced mathematics because it grants one access to economic opportunities and the ability to navigate and participate in a society that is rapidly advancing technologically. He argues that the increasing reliance of modern society on mathematics makes it the new frontier in civil rights, much like basic literacy has been in the past. According to Moses, in order for people of all backgrounds to gain equal access to full participation in society, they must gain access to higher mathematics.

A focus on functional literacy positions mathematics as a means to participate socially, economically, and also politically in society. The idea is that mathematics education, from basic to advanced, equips citizens with the competencies necessary to participate in the workforce of an increasingly technological society, to proficiently navigate such a society, and thereby to have a voice in shaping this society. Watts and Guessous (2006) offer complementary findings about the link between mathematical competency and civic engagement; they found that competency associated with mathematical expertise is linked to individuals' sense of agency and likelihood to become civically engaged in general. Learning mathematics as a subject, from basic skills to higher-level topics, provides students with the skills, credentials, confidence, and even the inclination to function as a citizen on a personal and societal level. Although functional literacy can lead to citizens engaging in society in multiple plays, as Apple (1992) pointed out, this perspective assumes an acceptance of the established structures and dominant cultural norms, including an acceptance of the discipline of mathematics as a vehicle for increased participation in these norms. The next section presents several perspectives presenting broader, more critical visions of mathematics education that seek roles for mathematics that go beyond functional citizenship.

### **Mathematics Education for Democratic Citizenship**

Stemhagen and Smith (2008) attempt to remedy what they declare to be an inadequate foundation for a democratic vision of mathematics education. Rather than focusing on the role of mathematics in functional citizenship, they connect mathematics to democratic citizenship, which they define as “giv[ing] back to society” (p. 27). According to Stemhagen and Smith, mathematics education is a fundamentally ethical

pursuit that directly contributes to students' development as democratic citizens. They propose a democratic re-conceptualization of mathematics education based on the ideas of John Dewey, who demands that education be based on experience and determined by aims that are directly relevant to the learner and to society. Applied to mathematics education, this means that rather than students learning mathematics for its own sake, students should learn mathematics as "tools from which they can choose to help carry out their inquiries" (p. 34). Stemhagen and Smith call for a mathematics education that engages students in mathematical problem solving about contexts that are relevant to their lives. They argue that by rooting mathematics education in the context in which people actually use mathematics, not only do students learn mathematical skills but they also develop an understanding of the "human elements" of mathematics as well as its "democratic possibilities" (p. 36). In other words, engaging students in using mathematics in meaningful contexts develops them as citizens by cultivating their capacity to make contributions to the shared interests of the collective.

Winslow (1998) takes a linguistic approach to understanding the justifications for mathematics education. Winslow describes mathematics as a unique language that enables "global, noise-free human interaction" (p. 23). Winslow argues that fluency in mathematics also bolsters democratic processes by enabling participants to be able to understand and criticize the mathematical models that shape a certain view of the world. This is related to Skovsmose (1992)'s argument for matheracy, a mathematics version of literacy that includes mathematical, technological, and reflective knowing. Skovsmose argues that democratic competence depends not just on mathematical and technological knowing (knowing how to perform mathematical algorithms and how to engage in



mathematical modeling), but also reflective knowing (being able to think about how the mathematical formalizations and models have shaped our world).

What these perspectives have in common is the positioning of citizens as agents, not just participants, in society. They emphasize the importance of not just knowing and using mathematics but understanding its role in structuring society and its potential to empower citizens to challenge these structures. Gutstein (2006) brings these perspectives together in a framework for teaching mathematics for social justice. Mathematics for social justice is characterized by its approach of engaging students in “reading and writing the world with mathematics,” which Gutstein (2006, p. x) adapted from Freire’s approach to literacy. Proponents of a critical approach to education in general argue that this approach is a means towards the liberation and empowerment of marginalized peoples (Freire, 1993; Gutstein, 2006). Reading the world with mathematics involves using mathematics as a tool to critically analyze and understand how society works—to understand the unequal power relations behind policies and institutions and how they shape people’s lives. Writing the world with mathematics is using mathematics to support actions taken in response to the injustices that have been uncovered.

Like Stemhagen and Smith (2008), Gutstein (2006) promotes a vision for mathematics education that is closely tied to addressing real world issues in students’ lives that affect the interests of the collective. However, mathematics for social justice focuses on examining issues of systemic injustice at its core. In doing so, it is not dismissing the role of mathematics in solving problems that are not related to justice, but it is asserting the idea that omitting the role of mathematics for examining injustices ignores the role of mathematics in analyzing and shaping the dominant structural forces

in society. In essence, mathematics for social justice renders all non-justice-based approaches as promoting functional literacy because failing to critically examine social structures means accepting them as assumed. As Gutstein (2006) states, functional literacy is “any set of competencies that do not engender the systematic search for the root causes of injustice, but instead leaves unexamined structural inequalities that perpetuate oppression.” Based on this view, functional literacy is important but insufficient; a critical approach is necessary to empower citizens towards emancipation and justice for all people.

The various perspectives described in this section reflect how mathematics education for citizenship can be conceptualized differently, depending on one’s conception of the relationship between mathematics and citizenship. Functional views position mathematics as an element in strengthening individuals’ skills and competencies that grant them access to important roles and means of participation in society. A focus on critical and democratic aspects of citizenship lead to envisioning mathematics as essential for individuals to become critical agents of change. This study examines the conceptions that youth have about mathematics, citizenship, and the relationship between mathematics and citizenship to understand whether and how youth take up the mathematics they learn in their lives, both in terms of functional and democratic or critical citizenship. I take the perspective, however, that a functional view of citizenship is insufficient for empowering full citizenship. In order to empower citizens who have agency in, not only participating in civic life, but also truly shaping the conditions that affect their lives and society, education for critical citizenship is essential. Empowering citizens to make meaningful change requires enabling a deep and critical examination of

the systems and structures that govern society and uncovering the unequal power relations behind them. In this study, I draw on mathematics education for social justice to examine the potential for such an approach to empower youth as critical agents and to alter their perspectives about how mathematics can contribute to their sense of agency as citizens. The research questions for this study are summarized in the following section.

### **Research Questions**

This study offers a systematic analysis of the relationship between youth's conceptions of citizenship and their conceptions of mathematics using explicit frameworks about these conceptions. In addition, this study offers insight into how youth's conceptions shape and are shaped by their experiences with a social justice mathematics approach. I use the term youth to refer generally to the population of young people that are between childhood and adulthood, since my study does not include children below middle school. Throughout the study, I most often use the term students to refer to young people specifically in a school or learning environment; in particular, the data chapters refer to the research participants as students to refer specifically to the youths in the classes that I interviewed rather than a general population.

This study poses three main research questions:

1. What are youth's conceptions about what it means to be a citizen?
2. What are youth's conceptions about mathematics and their conceptions about the role of mathematics in citizenship?
3. How can a social justice mathematics approach influence students' conceptions of mathematics and citizenship?

Studying youth's own conceptions of citizenship is important because it provides a window into how they view their own role in society and their sense of agency to effect change. Examining youth's conceptions of mathematics and their conceptions of the relationship between mathematics and citizenship illuminates whether and how they perceive mathematics to play a part in this role. Understanding these conceptions provides insights into the ways in which mathematics education can and does foster, support, stifle, or otherwise shape youth as citizens, and it also provides a basis for learning about the potential for social justice mathematics approach to contribute to, enhance, or disrupt students' ideas and empower them as civic agents. Looking across two research settings with students who differ in terms of their relationship with schooling and their life experiences strengthens this study, as it provides an opportunity to examine different perspectives about what it means to be a citizen, how they view the role of mathematics and their mathematics education in contributing to citizenship, and thereby potentially surfacing different results in terms of the effects of experiencing social justice mathematics education. The research questions are addressed in their own chapters, which include findings from both research settings and conclude with a discussion about what we learn by looking across the two settings.

## **CHAPTER 2: FRAMEWORKS AND LITERATURE**

Understanding youth's own conceptions of citizenship and their own conceptions of mathematics is essential for grasping the role that their experiences with learning mathematics in school does or does not play in developing citizenship. In this chapter, I discuss various frameworks for understanding individuals' conceptions of citizenship and mathematics, in each case arriving at a framework that I utilize to guide my analysis of the conceptions of the students in my study. I then review the literature about conceptions of citizenship, conceptions of mathematics, and the potential for a critical approach to mathematics education to bolster students' agency as critical citizens.

### **Conceptions of Citizenship**

I start this section with an explanation for choosing to study citizenship rather than other related terms such as civic engagement. I then explain how different conceptions of citizenship reflect different visions about democracy and what it means to participate in a democracy. Finally, I present a framework that I used for analyzing the conceptions of citizenship of the participants in my study.

### **Why Citizenship?**

For this study, I struggled with whether to use the term citizenship or civic engagement. I recognize that the word citizenship is highly political, as it is used to indicate the status of persons as members of a nation in terms of meeting specific legal criteria. I was aware that the legal way to define citizenship had a high probability of manifesting in student conceptions of citizenship despite it not being the focus of my study. In addition, civic engagement comes closer to what I was interested in studying. I wanted to know what the youths in my study believed their role was in effecting change

in their communities and society. However, I chose citizenship for two reasons. First, I define citizenship broadly as the role of individuals in relation to their communities or society in general. This broad conception allows for me to seek an understanding of youth's interpretations of what this means for them, which may or may not include being civically engaged, rather than imposing a definition. Second, by emphasizing the non-legal way of thinking about the concept of citizenship through my study, I see it as a way to subvert the idea that citizenship is primarily about legal status. Based on this definition of citizenship, in the following section I explain how different conceptions of democracy shape different conceptions of citizenship, then I arrive at a framework for analyzing the conceptions of citizenship of the students in my study.

### **Conceptions of Democracy and Citizenship**

How citizenship is conceived is dependent on the vision of what it means to participate in a democracy. There are three main perspectives of democracy that are prevalent in this country: civic republican, liberal, and critical (Table 1). The civic republican perspective envisions a democratic citizen to be a participant in the established cultural, social, and political systems. According to the civic republican view, citizens should become well versed in the traditions of the nation, from its historical foundations to the literary canons of the western world (Gagnon, 1985; Ravitch, 1989; Pangle & Pangle, 2000). Politically, citizens should also have a clear understanding of how the political system works in order to participate in it through formal means, whether through voting, supporting, opposing, or electing (Ravitch, 1989; Pangle & Pangle, 2000). The assimilative nature of citizenship espoused by civic republicanism also leads to an

emphasis on character development, with values such as hard work and responsibility framed in a way that supports flourishing within the system.

The liberal conception of democracy, on the other hand, places individual liberty at the center, with the collective answering to individuals as opposed to individuals integrating into the collective. According to Levinson (1999), the key to achieving a liberal conception of citizenship is the development of autonomy, or the ability to see oneself as an agent who can deliberate and make choices. Autonomy allows citizens to not only make choices for their own lives but also to participate in the dialogue and reasoning necessary to come to collective agreements. In fact, it is the duty of citizens to participate in “conscious social reproduction,” or the constant reconstruction of society through deliberation by challenging, revising, and reinterpreting all elements of society and politics (Gutmann, 1987, p. 46; Macedo, 2000).

Finally, the critical (or radical) perspective defines democracy as a struggle among competing ideologies about power and society. A citizen, then, is an “active agent in questioning, defining, and shaping one’s relationship to the political sphere of the wider society” (Giroux, 1988, p. 29). This is like the liberal conception of citizenship in that citizens are expected to participate in critical thinking and dialogue in order to take part in the constant construction and revision of society. However, the critical conception of citizenship is committed to emancipation from the power exerted by oppressive forces rather than to mutual agreement through deliberation. Citizens must engage in criticism and dialogue insofar as they are standing in solidarity with others to combat the forces of power that create oppression through racism, classism, sexism, etc. (Giroux, 1988).

Table 1

## Conceptions of Democracy and Citizenship

	Civic republican	Liberal	Critical (Radical)
View of democracy	The system of government established by the nation's forefathers.	The system of government in which individuals deliberate to come to a collective agreement.	The struggle among competing ideologies about power and society.
Idea of a good citizen	An upstanding member of society that upholds the nation's history, traditions, culture, values, and institutions.	An autonomous individual who sees oneself as an agent who can make reasoned choices for one's life and for the collective.	An agent who engages in critically questioning and acting against oppressive structures of power.
How a citizen participates in democracy	Participating in formal civic and political institutions (voting, supporting, opposing, electing, volunteering).	Participating in "conscious social reproduction" by revising and reinterpreting all elements of society and politics through reasoning and deliberation.	Engaging in struggles against oppressive forces of power in society.

**A Framework for Analyzing Conceptions of Citizenship**

The three conceptions of citizenship are based on distinct notions of the relationship between the individual and the state, which are helpful to understand the philosophical and political underpinnings of conceptions of citizenship. However, they are less helpful in providing a framework for understanding how individuals, in particular youth, understand what it means to be a citizen in society because they focus on underlying beliefs about democracy and the relationship between the individual and the state. Westheimer and Kahne (2004), on the other hand, provide a framework based on what it looks like to be a citizen, which also consists of three conceptions: personally responsible citizenship, participatory citizenship, and justice-oriented citizenship (See Table 2). Their framework aligns with the three conceptions of democracy and citizenship. A personally responsible citizen is one who contributes to society by



developing characteristics such as being hardworking, honest, self-disciplined, generous, and responsible. A participatory citizen is described as one who engages actively in collective pursuits and institutions, such as community organizations, government, and community service. Finally, a justice-oriented citizen is one who sets out to analyze the social, economic, and political forces in order to uncover and act against injustices in society and its structures.

Table 2

Kinds of Citizens (Westheimer & Kahne, 2004)

	Personally Responsible Citizen	Participatory Citizen	Justice-Oriented Citizen
Description	<p>Acts responsibly in his/her community</p> <p>Works and pays taxes</p> <p>Obeys laws</p> <p>Recycles, gives blood</p> <p>Volunteers to lend a hand in times of crisis</p>	<p>Active member of community organizations and/or improvement efforts</p> <p>Organizes community efforts to care for those in need, promote economic development, or clean up environment</p> <p>Knows how government agencies work</p> <p>Knows strategies for accomplishing collective tasks</p>	<p>Critically assesses social, political, and economic structures to see beyond surface causes</p> <p>Seeks out and addresses areas of injustice</p> <p>Knows about democratic social movements and how to effect systemic change</p>
Sample Action	Contributes food to a food drive	Helps to organize a food drive	Explores why people are hungry and acts to solve root causes
Core Assumption	To solve societal problems and improve society, citizens must have good character; they must be honest, responsible, and law-abiding members of the community	To solve societal problems and improve society, citizens must actively participate and take leadership positions within established systems and community structures	To solve societal problems and improve society, citizens must question, debate, and change established systems and structures when they reproduce patterns of injustice over time

The framework is descriptive and therefore useful for analyzing individuals' ideas about what makes a good citizen, including their ideas about what it means to make change, or in Westheimer and Kahne (2004)'s language, "solve problems."

I use Westheimer and Kahne (2004)'s framework as a reference to characterize students' conceptions, not to place the students in one of the categories. In their study, Westheimer and Kahne developed the framework to characterize educational programs with civic goals, arguing that while there can be some overlapping features, they reflect "a relatively distinct set of theoretical and curricular goals" (p. 3). While programs may have a dominant approach in their goals, the conceptions of youth do not necessarily fit so neatly. Individuals may have hybrid or nuanced conceptions of citizenship, sometimes drawing on ideas from multiple categories. For example, an individual may state that being a good citizen means both being a nice, helpful person who works hard and volunteers while also organizing programs to help their community. In addition, how youth describe what it means to be a good citizen and what it means to address an issue or make change in one's community might be different. For example, a person may believe that a problem must be solved by someone stepping up to lead a community action but not necessarily believe that one must be that someone to be considered a good citizen. For these reasons, students' conceptions of citizenship and their ideas about the role of a citizen in making change are two constructs that are treated separately.

### **Conceptions of Mathematics**

This section begins by differentiating between conceptions of mathematics and mathematical beliefs. I then discuss various frameworks about conceptions of mathematics, and I propose a hybrid framework based on frameworks from the literature

to meet my particular needs in analyzing the data for this study. Finally, I discuss the importance of considering the school context as a factor in students' conceptions of mathematics.

### **Conceptions or Beliefs?**

Mathematical conceptions are encompassed under the larger umbrella of mathematical beliefs. The literature about mathematical beliefs includes students' perceptions of themselves as learners and their approaches and ideas about how mathematics is learned and taught in addition to their perceptions of what mathematics is. McLeod (1992), for example, defines mathematical beliefs as including beliefs about mathematics, beliefs about self, about mathematics teaching, and about the social context. Whereas some use the term mathematical beliefs to refer to one's ideas about what mathematics is, others use the term mathematical conceptions. In her discussion of research on teachers' beliefs and conceptions of mathematics, Thompson (1992) states that the word "conceptions" is more natural to use compared to "beliefs" when referring to teacher's ideas of mathematics as a discipline, "though the distinction may not be a terribly important one" (p. 130). She defines "conceptions" as "more general mental structure, encompassing beliefs, meanings, concepts, propositions, rules, mental images, preferences, and the like" (p. 130). Star and Hoffman (2005) take a harder stance on distinguishing conceptions from stances or beliefs, explaining that beliefs "refers to student assumptions about knowledge and knowing in addition to a range of other constructs (e.g., self-efficacy beliefs)" (p. 26). For example, defining mathematics as a difficult subject might count as a belief about mathematics but not a conception of mathematics. Like Star and Hoffman (2005), I use a narrower definition of conceptions

of mathematics. My focus is specifically on student's epistemological ideas about what mathematics is and the role it serves for individuals, society, and humanity.

### **Conceptions of Mathematics Frameworks**

Star and Hoffman (2005) use a framework developed by Grouws, Howald, and Colangelo (1996) to assess conceptions of mathematics that focus on epistemological aspects. The framework, measured by the Conceptions of Mathematics Inventory, or CMI (Grouws, 1994, as cited in Grouws et al., 1996), includes 7 dimensions, grouped into 4 themes: 1) the nature of mathematical knowledge (composition, structure, and status of mathematics knowledge), 2) the nature of mathematical activity (doing mathematics and validating ideas), 3) the essence of learning mathematics, and 4) the usefulness of mathematics. For each of the 7 dimensions, students' conceptions are categorized according to a polar scale, with an individual's conceptions as falling somewhere on a spectrum between the two categories for each dimension (See Table 3).

While the CMI is useful for delineating the numerous aspects of what makes up a person's conception of mathematics, the components are outlined as isolated pieces. In my study, I am most interested in the relationship between students' conceptions of what mathematics is and how that relates to how they view mathematics in relation to the real world. My focus is on students' descriptions of the nature and usefulness of mathematics. The other themes—the nature of mathematical activity and learning mathematics—are not the primary focus of my study, though they can be intertwined. For example, variables can be correlated to each other. Crawford, Gordon, Nicholas, and Prosser (1994) found that students who described mathematics as a collection of facts and formulas were more likely to have a surface approach to learning mathematics (i.e., rote

memorization, doing many examples) rather than a deeper approach (i.e., applying theory, choosing strategic and difficult problems to understand the concept). Individuals may also incorporate other dimensions as they discuss their views about the nature of mathematical knowledge; for example, someone may describe mathematics as algorithms used to obtain results. These other dimensions can therefore be helpful in forming a fuller picture of students' conceptions of mathematics, but they are considered as peripheral and supporting variables rather than the primary objects of study.

Table 3

Scales of the Conceptions of Mathematics Inventory (Grouws, 1994, as cited in Grouws et al., 1996)

I. Nature of Mathematical Knowledge			
1.	Composition of Mathematical Knowledge	Knowledge as concepts, principles, and generalizations	Knowledge as facts, formulas, and algorithms
2.	Structure of Mathematical Knowledge	Mathematics as a coherent system	Mathematics as a collection of isolated pieces
3.	Status of Mathematical Knowledge	Mathematics as a dynamic field	Mathematics as a static entity
II. Nature of Mathematical Activity			
4.	Doing Mathematics	Mathematics as sense-making	Mathematics as results
5.	Validating Ideas in Mathematics	Logical thought	Outside authority
III. Learning Mathematics			
6.	Learning Mathematics	Learning as constructing and understanding	Learning as memorizing intact knowledge
IV. Usefulness of Mathematics			
7.	Usefulness of Mathematics	Mathematics as a useful endeavor	Mathematics as a school subject with little value in everyday life or future work.

Crawford et al. (1994) and Petocz et al. (2007) offer frameworks about conceptions of mathematics that align with the interests of my study. Both frameworks focus primarily on the nature of mathematics as defined by the CMI—specifically on the dimensions of composition and structure—and also incorporate the dimension of usefulness. Crawford et al. (1994) conducted an open-ended survey with first-year university mathematics students in Sydney focusing on their conceptions about the nature of mathematics. The conceptions were categorized as either fragmented or cohesive and further subdivided to create a hierarchical framework, as outlined in Table 4. Each subsequent level in the hierarchy is inclusive of ideas from previous levels. For example, a student with the conception that mathematics is a complex logical system which can be used to solve problems may include rules and formulas as a part of her conception.

Table 4

Hierarchy of Conceptions of Mathematics (Crawford et al., 1994).

Fragmented conceptions
A. Maths is numbers, rules and formulae
B. Maths is numbers, rules and formulae which can be applied to solve problems
Cohesive conceptions
C. Maths is a complex logical system; a way of thinking.
D. Maths is a complex logical system which can be used to solve complex problems.
E. Maths is a complex logical system which can be used to solve complex problems and provides new insights used for understanding the world.

A limitation of this framework is that the ways the hierarchies within the two conceptions may not necessarily reflect different levels but different ways that students

responded to the question about what mathematics is. For example, the representative quote that Crawford et al. (1994) provide from the survey for someone whose response is categorized as level A is the following: “Maths is the study of numbers, and the application of various methods of changing numbers.” However, if the student were asked a follow-up question about whether and how mathematics relates to the real world, the response may have revealed a conception that is closer to level B. In this framework, describing how mathematics is applied or used is treated as revealing a more sophisticated conception of mathematics rather than as a response to a different though related question.

Table 5

Conceptions of Mathematics (Petocz et al., 2007).

Number	
Mathematics as connected with numbers (i.e., counting) and calculations Manipulations using basic arithmetic operations	
Components	
Math as a toolbox for solving problems using isolated techniques	
Modelling	Abstract
Links mathematics to the physical world. Attempt to study, understand, predict, or analyze the physical world and its patterns	Mathematics as a logical system or structure, a way of thinking based on logic Combination of creative and methodical Little to do with numbers and much to do with principles
Life	
Mathematics as integral part of life and as a way of thinking A way to approach life in an analytical manner to understand how life works (beyond modeling) Mathematics as a language of nature	

Extending the work of Reid, Petocz, Smith, Wood, and Dortins (2003), Petocz et al. (2007) examined the responses of undergraduate college students studying mathematics, mathematics education, or a discipline requiring mathematics studies such as engineering. Petocz et al. (2007)'s framework is also a hierarchy, but with modeling and abstract conceptions existing as parallel levels, each equally a pathway to the most sophisticated level of conception of mathematics as life, which combines the modeling and abstract perspectives. Petocz et al. (2007)'s framework addresses the limitation in Crawford et al. (1994)'s framework by integrating various conceptions of mathematics with conceptions about how mathematics relates to the world, except in the case of number and components (See Table 5).

I propose a hybrid framework that combines elements from Crawford et al. (1994) and Petocz et al. (2007) (See Table 6). Petocz et al. (2007)'s conceptions of mathematics as number and components are combined as fragmented conceptions of mathematics in order to incorporate what mathematics is with how it is used. The modeling and abstract conceptions are also both categorized under the umbrella of cohesive conceptions of mathematics in order to emphasize that these are not two separate pathways towards a conception of mathematics as life but elements that are both necessary and integrated together as one approaches a conception of mathematics as life. The idea is that the modeling and abstract perspectives are not mutually exclusive, though their distinction is useful in showing the difference between students who may have only developed conceptions in one of these perspectives. Like the referent frameworks, this one is also a hierarchy that is inclusive of ideas from previous levels.



Table 6

## A Hybrid Hierarchy of Conceptions of Mathematics

Fragmented Conception of Mathematics	
<i>What is mathematics?</i> Mathematics is a toolbox, a collection of procedures and definitions involving numbers and variables. <i>What is the relationship between mathematics and the real world?</i> Application of elements from the toolbox to find answers to problems.	
Cohesive Conceptions of Mathematics	
<u>Modeling</u>	<u>Abstract</u>
<i>What is mathematics?</i> Mathematics is numbers and/or concepts embedded in the real world <i>What is the relationship between mathematics and the real world?</i> Mathematics helps us understand the real world and its problems	<i>What is mathematics?</i> Mathematics as a logical system or structure, a way of thinking based on logic <i>What is the relationship between mathematics and the real world?</i> The logic of mathematics can be applied generally to thinking and problem-solving in the real world
Conception of Mathematics as Life	
<i>What is mathematics?</i> Mathematics is a way of thinking AND is embedded in the real world <i>What is the relationship between mathematics and the real world?</i> Mathematics provides a way of thinking that can be applied to understand the real world AND solve problems in it.	

The framework provides a reference for understanding individuals' conceptions of mathematics, but it does not capture nuances. Within each conception, the questions about the nature of mathematics (What is mathematics?) and its usefulness (What is the relationship between mathematics and the real world?) are both addressed specifically. Individuals' responses may fit with the descriptions of the conceptions to varying degrees. Take the hypothetical example of two students, one defining mathematics as basic operations that they can apply to many problems in and out of school and the other defining mathematics as a more extensive list of disjointed mathematical topics and algorithms (i.e., finding cube roots, simplifying expressions, and solving linear equations)

that can be used to solve problems but only rarely in the real world. Both students' conceptions portray mathematics as a toolbox of isolated techniques and ideas, though what they include in the toolbox and the degree to which they believe it applies to the real world are different.

### **Student Conceptions of School Mathematics**

The hypothetical example described presents another important consideration in understanding students' conceptions of mathematics and its relationship to the real world. The context of schooling often dominates students' conceptions of mathematics, with students primarily describing mathematics as a subject (Atallah, 2003). Schoenfeld (1989) found that students said that mathematics was less about being right or wrong than other subjects, explaining that this was on account of students receiving partial credit in mathematics class rather than believing that mathematics as a discipline is open-ended. The influence of the context of schooling on conceptions of mathematics can also create seemingly paradoxical views. Students have been found to express simultaneously the ideas that mathematics is about logic and understanding and that mathematics is mostly about memorizing (Schoenfeld, 1989; Grouws et al., 1996). This contradiction, according to Schoenfeld (1989), could be explained as students separating what they believe about what mathematics means in school (i.e., rules to memorize) from mathematics as a discipline in general (i.e., a system of logic). In other words, students may have a conception of mathematics as a school subject that is distinct from what they believe mathematics is supposed to be as a discipline. In my study, part of understanding students' conceptions of mathematics is learning about how they perceive school mathematics in relation to mathematics more generally.

## **Review of Literature**

In this section, I review the literature about the following: 1) youth's conceptions of citizenship, in particular for low-income youth and youth of color, 2) student conceptions of mathematics, and 3) the potential for mathematics education for social justice to bolster students' agency as critical citizens.

### **The Meaning of Citizenship for Urban Youth of Color**

Conceptualizing the relationship between mathematics education and citizenship is complicated by the fact that there does not exist one universally accepted idea about what it means to be a citizen. Different countries have different versions of democracy and governance, which are invariably reflected in their civic education curricula (Haste, 2010), and even within one nation there exist multiple sets of values and ideas about citizenship that can play out in schools (Westheimer & Kahne, 2004). These multiple conceptions lend themselves to different interpretations for educating our nation's young people for citizenship. Levine and Higgins-D'Alessandro (2010) state that civic education is intrinsically normative—it is “a matter of choosing and transmitting values to citizens so that they will build and sustain societies that embody particular forms of justice and virtue” (p. 115).

That there are multiple ways to conceptualize citizenship has implications for studying the civic development of youth. Some researchers have refuted the notion that the civic development of youth has necessarily become endangered by arguing that the ways in which youth conceptualize and engage as citizens are not well captured by traditional measures (Roholt, Hildreth, & Baizerman, 2007; Rubin, 2007; Westheimer, 2006). Stolle, Hooghe and Micheletti (2005) have found that civic engagement can look

different in modern times, when what seem like ordinary actions in one's life can take on strong political meanings. For example, an individual consciously choosing certain products or brands over others could be a redefined way to participate in a boycott.

On a deeper level, school curriculum and practices around citizenship development may reflect a definition of citizenship that may not include forms of youth engagement that would count under a different definition. Rubin (2007) points out that civic education in school focuses mainly on civic knowledge and defines civic engagement in particular ways, such as participating in debates. According to Westheimer (2006), the ways that youth engage civically outside of school do not line up with the ways that are reinforced in schools. He argues that “[t]he kinds of controversies, power-plays, social upheavals, movements, and networks that some youth avidly engage in outside of formal institutions are the same issues, ideas, and debates that are systematically stripped from the school curriculum,” and he describes the school curriculum and practices as “devoid of political content” (Westheimer, 2006, p. 19). In other words, youth may be actively engaged according to a more critical definition of citizenship that is more explicitly political, one that is neither legitimized nor developed in schools.

The inapplicability of traditional measures of civic engagement is even more pertinent for urban youth of color. By urban youth I mean youth living in large, dense cities with high levels of racial and socioeconomic diversity, which often includes a large percentage of youth who are of color and classified as low income. Hart and Gullan (2010) and Levinson (2010) both cite lower levels of trust in politics among urban youth of color as factors for lower rates of engagement according to traditional measures. Hart

and Gullan (2010) explain, “Minority, inner-city youth might resist engaging in traditional civic activity” because of the “seemingly intractable nature of problems in their neighborhoods and communities” (p. 83). Researchers also suggest that means of engagement or even knowledge about ways to participate in the community might not be as accessible to youth in urban contexts (Roach, Sullivan, & Wheeler, 1999; Hart & Atkins, 2002; Levine & Flanagan, 2010). Levine and Flanagan (2010) state that youth of color in urban settings do not have the same opportunities to participate in formal institutional settings such as school activities and community organizations that are crucial in accustoming youth to participation in civic affairs (p. 16).

At the same time, these researchers also acknowledge and show evidence that urban youth and youth of color are participating in non-traditional ways. For example, in her interpretation of data from the Civic Health Index by the National Conference on Citizenship in 2008, Levinson (2010) states that Blacks are more likely to participate in what she calls “outsider” activities such as protests rather than “insider” activities such as campaign donations or direct contact with officials. In the same vein, Hart and Atkins (2002) cite a 1996 national survey on youth indicators that reported that Black youth demonstrate greater interest in issues of social justice, community leadership, and contributing to society than their White counterparts; Hart and Atkins argue that data such as this suggests that there exists “tremendous potential for civic competence in urban youth [to] be realized” (p. 235). Roach, Sullivan, and Wheeler (1999) propose that civic activism may work best for poor minority youth in general given the current barriers they may face in gaining access to participating civically through institutions.

The studies reviewed in this section have important implications for my study. First, the studies suggest that a critical approach to citizenship, which focuses on challenging systems of oppression, offers a promising way to legitimize and build on the ways that marginalized youth already participate. Second, the idea that youth (especially youth in urban settings and youth of color) often participate in ways that do not match traditional measures reinforces the importance of learning about how youth understand citizenship and how they see themselves as citizens. In fact, researchers have called for more research on youth conceptions of citizenship from their own perspectives (Westheimer, 2006). Earlier in 2003, Kirshner, Strobel, and Fernandez made a similar call, though emphasizing the need to understand not only youth's conceptions but also the process through which these conceptions are formed.

Swalwell (2013) examined student conceptions of citizenship using Westheimer and Kahne (2004)'s framework, as I do in this study. Her study focused on students from privileged backgrounds attending an elite private school in a wealthy neighborhood that had a progressive orientation with a special curricular focus on social justice. Swalwell found that although all of the students in her study believed themselves to have a justice orientation, most actually exhibited a participatory orientation as "Benevolent Benefactor," who "[r]ather than recognizing any systemic dysfunctionality of the status quo, however, they framed injustice as a tragic misfortune in the lottery of life" (p. 6). This orientation positions those who face the injustices as passive beneficiaries of the goodwill of these privileged benefactors. An implication of this finding is that it is essential to understand the conceptions of underprivileged youth as agents in addressing the injustices they face in their own communities. For my study, examining the

conceptions of low-income youth in two different settings, one a traditional middle school in a predominantly Black neighborhood and the other an alternative education program for students who have disengaged from high school in a predominantly Latino neighborhood, can offer unique perspectives about what it means to be a citizen and to act on injustices in one's community and society.

### **Students' Conceptions of Mathematics**

How students perceive the role of mathematics in their civic lives is not only dependent on their conceptions of citizenship but also on their conceptions of mathematics. For example, a student who sees mathematics as a collection of rules and operations may only think of concrete computational applications for mathematics in which the goal is to obtain a concrete answer. On the other hand, a student who sees mathematics as a way of thinking or modeling real-world phenomena may be more inclined to view mathematics as a means to understand patterns and relationships in a real-world situation. Both can contribute to a citizen's engagement with civic matters, but they have profound implications on the way that mathematics is viewed as useful in such endeavors. This section outlines how students have defined mathematics and understood its relationship with the real world.

*Conceptions of mathematics.* By and large, the literature on beliefs and conceptions about mathematics indicates that students view mathematics primarily as computation, emphasizing the memorization of rules and basic operations with the goal of obtaining the correct answer as determined by an external authority such as the teacher or a textbook (Frank, 1988; Garofalo, 1989; Spangler, 1992). Even at the undergraduate level, a majority of students have been found to express fragmented rather than cohesive

conceptions of mathematics (Crawford et al., 1994; Petocz et al., 2007). The distribution of student's conceptions is not uniform across contexts. In various studies with high school students, those categorized as high achievers in mathematics according to performance in school have been found to be more likely to describe mathematics as a coherent system than as disconnected procedures (Schoenfeld, 1989; Grouws, Howald, & Colangelo, 1996; Frid & White, 1995). Students at the undergraduate level studying mathematics or a field requiring mathematics were found to have more meaning-oriented approaches to studying it (Macbean, 2004), and those farther along in these degrees had more sophisticated conceptions of mathematics (Petocz et al., 2007).

*Why study mathematics?* Students' conceptions of mathematics also includes how they perceive the role of mathematics in their lives and society—in other words, why do we care about mathematics and why do we study it? Examining students' ideas about the usefulness of mathematics provides insight about how students perceive the relationship between mathematics and their lives and society. Students generally express the belief that mathematics is useful. In his interview study of elementary-grade students, Kloosterman and Cougan (1994) found that by the mid-elementary grades, students were able to articulate examples of uses of mathematics rather than merely stating that mathematics is important because their teacher had told them so. Grouws et al. (1996) found that across achievement levels in school, students expressed that mathematics is useful in their lives, “though consistently more mathematically talented students respond in this fashion” (p. 28). More experience with mathematics does not necessarily translate into greater understanding of the usefulness of mathematics, however. In a follow-up longitudinal study 3 years later, Kloosterman, Raymond, and Enemaker (1996) found that



students' ideas about the usefulness of mathematics had not matured in substance.

Students often offered extensions or more instances of the same examples they mentioned in previous years. Chouinard and Karsenti (2007) found in their study of students in grades 7 to 11 that students in the later grades reported lower scores for the utility of mathematics.

A decline in students' beliefs about the usefulness of mathematics in the middle and secondary school years is not surprising when considering the types of examples that students name as uses of mathematics. Students from elementary school to postsecondary levels mention similar examples related to money, sports, everyday tasks like cooking, and computational aspects of jobs (Atallah, 2003; Frid & White, 1995; Kloosterman et al., 1996; Spangler, 1992). Such examples are limited to counting and arithmetic learned during students' elementary school years. Students have also often demonstrated limited views of what kinds of careers require mathematics (Kloosterman et al., 1996; Spangler, 1992), with some explicitly stating that most careers do not require mathematics (Frid & White, 1995). Other students express a belief that mathematics will be useful in the future but fail to elaborate beyond general statements (Frid & White, 1995; Kloosterman et al., 1996). Wood, Mather, and Petocz (2012) found that even among undergraduate students who were studying mathematics or a mathematics-related field, about 5% said that they did not know how mathematics would be relevant in their future careers. While the authors were optimistic about the approximately one-third of students who expressed that mathematics would be an integral part of their careers, they admitted that these statements were also generic and did not reflect a true understanding of how mathematics would play a role.

The belief that mathematics is useful is related but distinct from the belief that mathematics is important. The utility of mathematics may not be the only consideration for students in their conception of the role of mathematics in their lives and society. Frid and White (1995) named three interwoven factors that students articulated about the reasons why it is important to study mathematics: 1) the social status of mathematics, 2) the utility of mathematics, and 3) career aspirations. Although students might not believe that the mathematics they learn in school beyond arithmetic will be used in their lives, they may believe it to be important because it is highly valued by educational institutions and future employers.

*Conceptions of mathematics and citizenship.* The conceptions students have about the usefulness of mathematics are related to their conceptions of mathematics as a discipline. For most students, mathematics is a collection of disconnected procedures that can be applied to their daily lives, which most commonly involve simple arithmetic. Beyond this, students view the mathematics they learn in school as belonging in the realm of academics, which holds value and provides them the currency to access higher education and career opportunities. The role of mathematics in students' lives fits a vision of citizenship that includes functioning in society and becoming economically productive members of society.

The literature on student conceptions of mathematics raises several questions. First, what is absent in the literature about conceptions of mathematics is the notion that mathematics can serve civic aspects of people's lives and society. Nowhere is there a mention of students describing mathematics as having a role in understanding social and civic issues, to engage as civic members of society and participants in a democracy. In

her study of over 200 postsecondary female students' conceptions of mathematics in the Middle East, Atallah (2003) discussed her findings in relation to the five domains of people's lives that the Everybody Counts report by the National Research Council (1989) outlines as being influenced by mathematics, including practical, civic, professional, leisure, and cultural domains; and also in relation to five arguments that Winslow (1998) outlines for teaching mathematics, which includes democracy for informed citizenship. No participants mentioned anything that could be categorized as "civic" or "democracy."

Second, the literature does not address the differences in conceptions across contexts beyond mathematical backgrounds. The studies described here were conducted with predominantly White students in non-urban settings in the United States or with university students across the globe. Almost all of the students in my study identify as Black or Latino and live in low-income, urban communities. In addition, one of the settings in my study is an alternative education program for youth who, for one reason or another, have disengaged from school. How do these students conceptualize what mathematics is, and how do their particular experiences with schooling influence their conceptions? What do they believe is the role of mathematics in their present and future lives? This study provides deeper insights into how students from marginalized communities conceptualize mathematics and its role in their lives, including specifically how that translates to how they perceive its role in their development as citizens.

### **Developing Citizenship Through Social Justice Mathematics Education**

Studies examining the implementation of a critical approach to mathematics outline numerous possibilities and challenges for integrating civic education into the mathematics classroom. These studies provide evidence that a social justice mathematics

approach can directly impact students' development as citizens. Gutstein (2006, 2007) provides an account of implementing social justice mathematics projects in a middle school classroom with predominantly low-income Latino students. Gutstein (2007) recounts how through mathematical investigations of social justices in their local and global communities, his students developed sociopolitical consciousness as well as a sense of social agency. For example, in response to a particular project in which his students performed mathematical investigations around gentrification in their neighborhood, the students gained a sociopolitical understanding of a real issue in their lives and also took civic action on the issue by participating in hearings and rallies to voice their protests. Engaging in these efforts influenced students to see themselves differently as agents of change in society. In a chapter containing student perspectives, a student writes that she was able to "see that change, and change by us, was possible" (Gutstein, 2006, p. 173).

Turner and Font Strawhun (2005) similarly engaged students in civic action following an investigation of the issue of overcrowding at their school. The students took part in a mathematics unit in which they found that their school, which served a predominantly non-White population, was being allotted less space than a neighboring school serving a predominantly affluent White population. In response, the students distributed flyers and made a large display of the school's floor plan to inform others, including the school board, of their findings and demands for more space. Turner and Font Strawhun (2005) state that despite a lack of response from the district, the students "felt good about contributing to the public discussion" (p. 86). By engaging students directly in examining and acting on social issues in their communities and in the world,

implementations of social justice mathematics have proven to elicit students' enactment of critical citizenship and a sense of empowerment as social agents whose voices and actions matter.

The implementations of social justice mathematics such as those of Gutstein (2006, 2007) and Turner and Font Strawhun (2005) also have implications for students' conceptions of the relationship between mathematics and citizenship. In both cases, students' experiences in using mathematics to critically analyze and act on an issue of justice revealed to them that mathematics could be a source of empowerment in sociopolitical struggles. One student was so convinced of the power of mathematics that he "showed others how to question and how math plays an intrinsic role in the process of changing your neighborhood" (Gutstein, 2006, p. 171). Turner and Font Strawhun (2005) report that after their investigation and action on the issue of overcrowding, students said that mathematics allowed them to be able to provide stronger support for their arguments about overcrowding, which "made our argument make more sense" (p. 87). The students in both studies demonstrated a conception of mathematics as being intricately tied to their ability to engage meaningfully to take civic action.

Social justice mathematics education opens up opportunities for considering deliberate means of integrating civic education with mathematics education. Mathematics for critical citizenship is especially promising given that its fundamental emphasis on uncovering and questioning systems of power aligns with the activism found in marginalized youth. By examining youth conceptions of citizenship and mathematics, this study provides a particular lens to illustrate the relationship between the two and to

show the role that mathematics education—in particular a critical approach to mathematics education—can contribute to youth’s development as citizens.

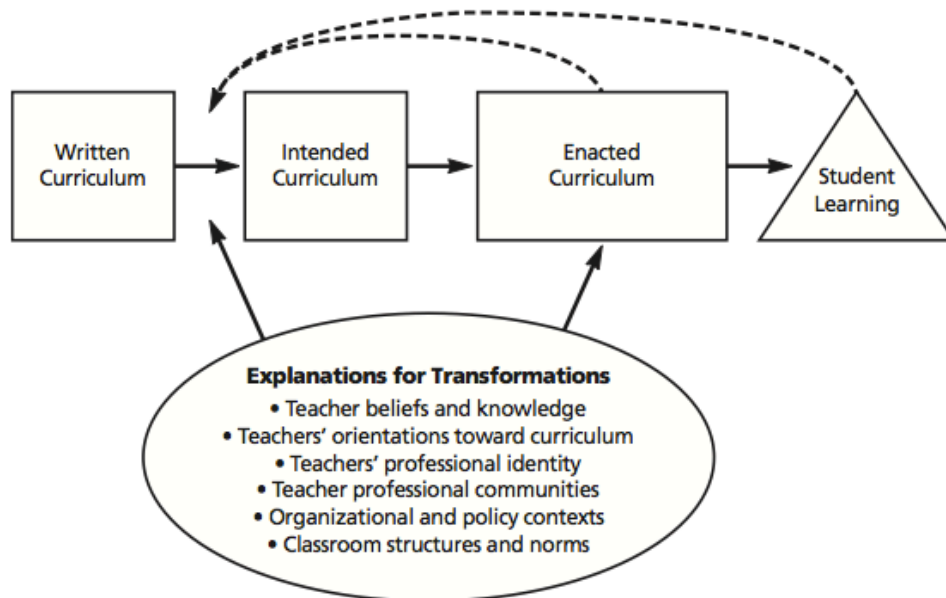
## **CHAPTER 3: METHODS**

### **Methodology**

This is a multiple case study about youth conceptions of mathematics, citizenship, and the relationship between mathematics and citizenship in two research settings. The intent of including two cases is not to provide a direct comparison of the two settings. Rather, as this is a study with an exploratory design, juxtaposing the cases can bring out interesting elements that may have been missed if the study had focused on a single case (Yin, 2003). Multiple forms of data were collected to learn about the contextual elements of the two settings and to document the classroom experiences of the students, and to learn about students' conceptions, including the following: 1) teacher and student interview data, 2) teacher/researcher meeting notes and recordings, 3) class observation notes from each session, and 4) artifacts from class sessions. This study is primarily focused on analysis of interviews with the students. Interviews are particularly fitting for addressing the research questions presented here because they are an effective means through which to understand individuals' beliefs and their perceptions about their own experiences as well as their interpretations of these perceptions (Weiss, 1994). Individual interviews with students in this study provided a way to listen to their particular ways of describing their conceptions of citizenship, mathematics, and the relationship between mathematics and citizenship. The interviews also provided a way to learn about the students' experiences with and reflections on the social justice mathematics curriculum that their teachers and I co-designed.

By relying primarily on student interviews, my study focuses on students' perspectives and experiences with the curriculum, or what Stein, Remillard, and Smith

(2007) call student learning (see Figure 1). According to Stein et al. (2007), curriculum does not have one stable identity but undergoes transformations as it is written by curriculum writers, interpreted and enacted by teachers in conjunction with students, and experienced by students. These transformations do not occur in a vacuum but are situated amidst several factors, including teacher beliefs, knowledge, orientation, and identity, as well as factors related to both the context of the classroom and the larger organizational and policy contexts of the school and society.



*Figure 1.* Curriculum transformation framework (Stein, Remillard, & Smith, 2007)

In my study, the teachers and I collaborated on conceiving and writing the curriculum, and the teachers implemented it. Recordings and notes of planning meetings provide insight into the written and intended curriculum, while notes of class observations detail the enacted curriculum. Interviews with the teachers and notes about



the setting provided insight into the factors influencing curricular transformations. However, these sources of data are used to provide general contextualizing information about the settings, teachers, and the curriculum in this study. Ultimately, my study is intended as a close analysis of students' conceptions and how an experience with curriculum intended for uncovering issues of injustice in their community might influence these conceptions. While I acknowledge that the teachers' orientations towards the curriculum and the ways in which the curriculum was consequently written, intended, and most importantly enacted directly influence students' experiences and learning, a systematic analysis of these factors is beyond the scope of this paper, though excellent material for follow-up work to supplement the findings presented here.

In addition, my own particular perspectives about what it means to be a citizen shape this study. When finding teachers to become my partners for this research, I intentionally sought out individuals who demonstrated an interest in designing and implementing lessons that engage students in examining issues of social justice through mathematics in their classrooms. Although I believe that mathematics plays an important role in functional citizenship and in aiding students to become problem solvers in any real-life situation, mathematics for the purpose of social justice is my main pursuit. However, I recognize that the teachers that I worked with had different ideas about the balance of these various roles that mathematics education plays in the development of their students as citizens. As Apple (1995) states, even the meaning of social justice teaching is "struggled over, in the same way that concepts such as democracy are subject to different senses by different groups with sometimes radically different ideological and educational agendas" (p. 335). Just like individuals' personal understandings about the

meaning of citizenship are complex and nuanced, so are our perspectives about engaging students in mathematics for citizenship and for social justice. Despite our nuanced perspectives, the mathematics curricula that the teachers and I created all have the common element of engaging students in examining and reflecting on aspects of society, in particular their local communities, through the lens of mathematics. While the complexities and the nuances are not the focus of my study, the descriptions I do provide about curriculum, the teachers, and the settings are considered in discussion points throughout the paper.

In this chapter, I outline the settings and methods of my study. First, I describe the two research settings, including the students at these settings and the teachers with whom I collaborated. Second, I provide a general overview of the social justice mathematics curricula that the teachers and I designed and implemented at each setting. Third, I explain how the data was collected and then analyzed to address my research questions. Finally, I address my identity and positionality as a researcher.

### **Research Settings**

I collaborated with two teachers from different settings for this study. The first teacher, Diana, was a middle-school mathematics teacher at Maynard Hewitt Public School<sup>1</sup>. The second teacher, Olivia, was a teacher of multiple disciplines at the Learning for Career and Life Center (LCLC), an alternative education program for out-of-school youth who did not obtain a high school diploma. I met both of the teacher collaborators through their involvement in a professional development program called the Community

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<sup>1</sup> All names, including the names of the teachers, the students, and the schools are pseudonyms.

Based Mathematics Project (CBMP). The program was established in the summer of 2010 as a professional learning community bringing together mathematics educators including teachers, university faculty, and graduate students to learn about and design mathematics lessons based in contexts relevant to students' interests and communities. Diana and Olivia both joined CBMP in 2011 and became active members of the group, and they also both participated in a continuing education course run by CBMP. In the course, participants experienced and reflected on mathematics activities based in locally relevant contexts while also discussing articles about mathematics education as it relates to context, culture, and society. As one of the graduate students running CBMP, I interacted with all of the participants on a regular basis and at the end of the course chose to approach Diana and Olivia about partnering with me for this project over the 2011-2012 school year. Both participants agreed, seeing this as an opportunity to receive support in designing and implementing locally relevant and justice-oriented mathematics lessons with their students.

In this section, I describe the institutional settings, the student participants, and the teacher collaborators for this research. In particular, I provide extensive detail about the teachers and the students gathered from data from their individual interviews. In terms of the teachers, I describe their backgrounds and their goals for and relationships with their students. Understanding these aspects about the teachers is essential, as the teachers played a consequential role as co-creators and implementers of the social justice mathematics lessons that their students experienced as part of this study. In terms of the students, I include some background information and their future aspirations as a basis for comparison between the students in the public middle-school setting and the students

at the alternative education program, many of whom had already been part of the work force or had more immediate plans to do so. Learning about their future aspirations provides a sense of how the students might see themselves in relation to their goals in the world outside of school. For the students at the alternative education program, I also describe the reasons why they disengaged from high school to better understand their relationship to schooling.

### **Maynard Hewitt Public School**

*Setting.* Diana was a middle-school mathematics teacher working at Maynard Hewitt Public School. Hewitt was one of the district's neighborhood schools serving kindergarten through eighth grades. It had an enrollment of about 350 students during the year of the study, though this number had declined from over 400 two years prior and over 500 six years prior<sup>2</sup>. The school closed down two years after the study was over. The student population at Hewitt consisted of 92% of students categorized as African American, 5% Latino, less than 1% White, 0% Asian, and about 2% in the "Other" category. A majority of the students in the school were from the neighborhood and lived in low-income housing units down the street from the school, and 96% of students were categorized as economically disadvantaged. Academically, the students at the school typically performed below average on the state examination. The school made its target for Annual Yearly Progress (AYP) in 2010 but not in 2011.

Despite the school's performance and eventual closing, the environment I observed was largely positive. The school primarily served the local student population,

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<sup>2</sup> School demographic data was obtained through the school district website but is not cited here for purposes of confidentiality.

many of them living in the low-income housing development that was located in the same block, so the school and the adults in the school were part of the students' community. The majority of the students had attended Hewitt for most of their lives, and many had siblings and cousins who were also in the school or had attended in the past. Diana had a positive relationship with other teachers as well as the principal, who had served the school for many years, and the school strove to provide positive messaging to its students. For example, the school led an anti-bullying program, and the following statement replaced the standard pledge in the morning: "I am respectful, I am responsible, I follow rules and I am a positive role model."

For this study, Diana and I chose her 8<sup>th</sup> grade mathematics class to participate in the study. The 8<sup>th</sup> grade class met at the end of the day during a 90-minute block, the length of all mathematics classes in the school. In addition, Diana was the lead teacher for the 8<sup>th</sup> grade, so these students saw her earlier in the day during advisory, a shorter period that was devoted to announcements and other extracurricular programming.

*Students.* There were thirty 8<sup>th</sup> grade students in Diana's class, and they made up the entire 8<sup>th</sup> grade in the school. This number had changed over the course of the academic school year as a couple of new students had matriculated into the school. Demographically, the students in this class were representative of the demographics of the students in the whole school. Most of the students identified as coming from low-income families and all but one identified as African American (one male student identified as Latino and spoke Spanish in his home, though he declined to be interviewed for the study). Out of the 30 students on the roster, 21 consented to be interviewed for the study, 10 female and 11 male, and they were generally representative of the students

in the class. A majority (12 of 21) of the student participants in the study reported living in the neighborhood and attending Hewitt since kindergarten or first grade, while only 5 had lived in the neighborhood for fewer than three years. Diana had taught the 7<sup>th</sup> grade mathematics classes the year before, so for 17 of the 21 participants, this was their second year having her as a teacher.

The students at Hewitt expressed a range of future career goals. Many students named careers that they learned about through the media, especially the male students. Six of the 11 male students in the class said they wanted to become professional basketball players in the future, though four of them also named a secondary profession in case they were not successful with basketball. One student, Ferrell, said he wanted to become a lawyer based on watching television shows. Another student, Jesse, aspired to be a chemist, physicist, and medical doctor, partly because he identified with Sheldon—a character from the television show *The Big Bang Theory*, who is a brilliant physicist though often socially awkward and humorously irritating but still loved by his friends. Other students cited people they knew, such as a parent, older sibling, or other relative as influencing their career aspirations. Three students said they wanted to go into construction (of whom 2 named it as a backup to a basketball career) based on experiences with a relative. Similarly, some of the female students said they wanted to pursue nursing or cosmetology because of someone they knew. Other careers that students named include becoming a pediatrician, chef, investigator, writer, tattoo artist, and fashion designer. One student, Reggie, said he would be a mathematics teacher if he did not become a professional basketball player.

*Teacher.* Diana, who the students called Ms. Fuller, was a middle-aged, African-American woman from South Carolina, where she grew up and attended college. Diana majored in language arts in school and then took a job in New York in the proofreading department of an accounting firm. Diana identified as Christian and had been a regular churchgoer throughout her life. She decided to become certified in teaching from Bank Street Graduate School, a progressive teacher education institution, in the early 1990s after learning that she had a gift for teaching through a spiritual gifts test that she took at her church. At Bank Street, Diana became interested in teaching mathematics after learning about a model of teaching that focused on process rather than rote learning. Though she was certified in both mathematics and language arts, she chose to become a mathematics teacher once she began her teaching career.

The year we worked together, Diana was teaching two 7<sup>th</sup> grade classes and one 8<sup>th</sup> grade class at Hewitt. Diana had been working as a middle-school mathematics teacher at Hewitt for 12 years, the whole of her teaching career. Diana also ran the school's chess club, which met weekly after school; several of her students, in particular ones who were successful in her mathematics class, participated in the club. In addition to teaching and running the chess club, the principal also often relied on Diana to help lead and coordinate school events, including all grade-wide activities for the 8<sup>th</sup> grade and school-wide activities like the spelling bee and school pep rallies.

Diana's leadership reflected her dedication to the school and to her students. Although she lived in a wealthier neighborhood on the outskirts of the city, Diana was an integral part of the community of her students. She stayed after school for several hours every day, including days when she was not running a club or program, to make herself

available to her students. Every day, a few students would stay in her classroom completing their homework and conversing with her about their lives while also socializing with each other. Sometimes, younger siblings of these students would also join and receive guidance from Diana. In addition, because many of the students who had graduated from Hewitt still lived in the neighborhood, Diana had former student visitors on a regular basis. In some cases, Diana even served a parental role for the students. For example, one of Diana's former students needed to take a ballet course in order to meet the requirements for a dance program in her arts-focused high school but did not have an adult who could take her, so Diana took the course with her. One day, this student visited Diana during one of our meetings after school, and when the students' mother called her, Diana took her phone and began to chat familiarly with her mother. Diana was more than just a teacher to the students; she was woven into the fabric of their community.

The investment that Diana had in her students was also reflected in her goals for them. As a mathematics teacher who embraced the progressive teaching philosophy of Bank Street, Diana's goal was to push students away from an algorithmic approach to mathematics. She said, "I want to liberate my students from algorithms ... I want them to see a lot of possibilities for math, to make sense of math in their head and not just have this kind of girdled approach to, you know, problem solving." Diana saw her learning from CBMP as a way to strengthen her abilities as a teacher to make mathematics more meaningful for students. However, Diana expressed often feeling constrained by district mandates. In the classroom, she was required to use *Mathematics in Context* alongside several workbooks. The workbooks were aimed at developing students' procedural



fluency, and although the textbook was based on a contextual approach to mathematics, Diana felt pressured by rigid requirements about pacing and meeting standards. Still, Diana had some flexibility, in particular when it came to designing the 8<sup>th</sup> grade project, a multidisciplinary project based on a theme. For example, the previous year, Diana designed a project around healthy eating and exercise.

As the example of the project indicates, Diana also had non-mathematical goals for the development of her students, particularly because of her students' underprivileged backgrounds. Although her peers at Bank Street had encouraged her to apply for a position in a private, progressive school that aligned with her teaching philosophies, Diana decided to work instead at an urban, public school because it reflected "the heart of the urban population." Although Diana clarified that she did not necessarily seek to work with African American students but rather with a population of students that were an authentic reflection of the city, her identification with her students based on race led her to have particular ideas about what she wanted to impart on them. Diana admitted that as a descendant of slaves, she saw herself as "rarely a part of the mainstream," and that she was aware that her freedoms were not free but "fought by somebody's sacrifice." Consequently, she had a strong sense that it was important to work hard to honor that sacrifice. As a teacher, she sought to instill in her students a sense of worth along with the knowledge to empower them to exercise their freedom to pursue success and to "control your life through informed decisions and responsible actions." Diana recognized injustices that plagued the communities of her students, and her approach was to combat these injustices through these informed decisions and responsible actions. For example, the project around healthy eating and exercise was designed in response to her concern

that the options for healthy eating in an urban environment are “horrendous” and have grave consequences, such as higher obesity rates. For Diana, the way to address this injustice and “rebalance the scale” was to “inform somebody of their right to a good life,” which in this case meant teaching students to make healthy choices for themselves and for their families. This approach does not align with a justice-oriented approach to citizenship, as it focuses on remedying the symptoms of the issue and not the systemic inequalities. However, Diana was open to the new approaches, including justice-oriented approaches she was exposed to through CBMP, as she said she wanted to learn to be more “free.”

### **The Learning for Career and Life Center**

*Setting.* Olivia was a teacher at The Learning for Career and Life Center (LCLC). The LCLC was a voluntary educational program for out-of-school and formerly adjudicated youth. The students at the LCLC were older and had more life experience than the students at Hewitt. The LCLC provided classes to prepare its students for the General Equivalency Development (GED) test, which measures proficiency in reading, writing, science, mathematics, and social studies and is a means to earn a high school equivalency credential for those who did not attain a high school diploma. In addition, as the name of the program indicates, it also provided its students with case management services and various special programming to support them in job-readiness and other general life empowerment opportunities, such as health education and mentoring. There were several LCLC sites throughout the city; the site for my study was run by a community organization serving the Latino population in the city.

The LCLC followed a structured schedule broken down into 50-minute increments by subject. The students began every day from Monday to Thursday with mathematics and reading sessions in the morning, followed by a combination of writing, science, social studies, special programming, and tutoring sessions that varied from day to day. On Fridays, there was usually a field trip or other special programming scheduled for all of the students. The programming changed in December, when a large new cohort of students was admitted. After a transitional period, by mid-January the students were broken up into two groups, taught by two different instructors, according to the students' pre-assessment performances in the subjects. The students in Olivia's mathematics class represent the students from the program that had scored higher than their peers on the Test for Adult Basic Education (TABE). In May, an afternoon session was added for mathematics and reading.

Enrollment at the LCLC was on a rolling basis, with several dates over the semester when a new group of students would begin to attend. There were also new students who matriculated individually throughout the course of the program, and students who were leaving on a rolling basis as they completed their GED requirements and passed the exams. Some students were also let go due to poor attendance, disruptive behavior, or other reasons as decided by their instructors, case managers, and program coordinator. Attendance was also irregular. Although there were about 10 students on the class roster at any given time, there were usually about half in attendance, with some attending more regularly than others. Between the volatility in programming, enrollment, and attendance, there was a high degree of change and unpredictability in the makeup of the classes.

*Students.* The students at the LCLC were older than those at Hewitt, with ages ranging from 17 to 21. They also represented a range in terms of their reasons for disengaging from traditional school settings and their life circumstances in general. Learning about the circumstances of the students who participated in the study is important to understanding how they see their role as citizens in society.

There were 7 female and 10 male students interviewed at the LCLC. All of these students had dropped out of high school within the last few years. The LCLC was situated in a predominantly Latino neighborhood, and the student participants reflected this demographic. A majority of the students identified as Latino/a, many of whom were Puerto Rican or of mixed race/ethnicity; two of the students were Black and one was White. Most of the students had lived in the area near the LCLC for most, if not all, of their lives. Five students reported having moved to the neighborhood within the past few years, primarily from Florida. The students at the LCLC were not only older than the students at Hewitt, they had more out-of-school life experiences. Some held jobs while attending the LCLC, and some had years of experience behind them working as mechanics, construction workers, and factory workers. One student, Raul, was making a living as boxer. Many were no longer living with their parents and were on their own or living with siblings or other family members, and several students mentioned being parents to babies or small children.

The reasons that students provided for leaving school varied widely. Most of the students cited issues related to school, such as failing too many classes, missing too many days of school, or getting in trouble in school and being kicked out. A few had external circumstances that took them away from school and made it difficult to return, such as

pregnancy, needing to financially support family, or being arrested. Regardless of the reasons, a significant number of students described leaving school as a choice they made rather than a situation that happened to them. For example, two students (Nila and Shaquan) described schools as failing them with poor teaching rather than seeing themselves as failing in school. Another student, Hector, said he struggled with fighting in school and chose to leave because he no longer wanted to be in that environment. Yet another student, Zohelia, described school as being too distracting and wanting to be with more “grown-up people” as opposed to “ignorant people.” The students at the LCLC had chosen to leave traditional schooling and taken the initiative to pursue attaining a GED credential.

Despite leaving high school, the students at the LCLC were highly motivated; they sought to obtain a better life and employment opportunities through obtaining their GED. None of the students wanted to continue in their current or previous jobs and had other aspirations. The students named specific careers they sought, including being a nurse, emergency medical technician (EMT), paralegal, electrician, coastguard, or drug enforcement officer. Some even named specific steps they were planning to take, such as applying for internships and apprenticeships or enrolling in community college. In addition to these practical goals, the students were also motivated by the desire to become accomplished people in general. Three students mentioned wanting to be or to follow good role models in their family. Lara, who was the only student who did not name a specific idea for her future, simply said, “I want to have something better. I want something for myself so I know that in the long run, I did it for myself, I did it for nobody else. And just accomplishing things that nobody in my family did.”

*Teacher.* Olivia, whom the students called Ms. Olivia, taught reading, mathematics, and writings classes and was also sometimes in charge of leading special programming activities. Olivia did not have formal teaching credentials, but she had worked at the LCLC for a year before participating in the study, and she had previously worked as a test preparation instructor for the Law School Admissions Test (LSAT).

Olivia was born and raised in Detroit before moving to the northeastern United States for her undergraduate degree about ten years prior to the study, and she had remained in the region ever since. Olivia identified as a Black woman, a Christian, and a progressive. She joked that she was “practically conceived in the church” because it was such a central part of her upbringing, and up until the eighth grade, she attended a rigorous, private, Christian academy that served predominantly Black students. Her exposure to diversity in her public high school and in youth theater shaped her progressive beliefs, and her passion for social justice was solidified as she experienced racism at her undergraduate institution and as she learned more about social justice from an academic standpoint as she pursued a major in urban studies. Olivia continued to be strongly connected to the church, and, by the end of our year working together, she had enrolled in seminary school. For Olivia, her passion for social justice and her faith were intricately connected: “Like I’m not interested in... sort of waxing poetic about scripture. I’m interested in justice and how that is profound, moral, and right.”

Incorporating justice into her class was not new for Olivia. In the past, she had discussed with her students various issues dealing with race and injustice. For example, she introduced her students to the story of Henrietta Lacks, a Black woman whose tumor cells were harvested in the 1950s without her or her family’s permission and became

critical for scientific and medical research. Olivia was not afraid to voice her opinions about injustices directly, but she also was conscious of allowing students room to form their own opinions. In fact, she explained that her initial goal when starting to teach was to inspire her students to want to “beat the man” and “be as pissed off as I am” about injustices, but then realized she wanted to be less prescriptive and instead expose students to new information and opinions while encouraging them to “arrive at their own sense of justice.” Also, while justice was central to Olivia’s core philosophies that she brought to teaching, it was only a part of a greater vision that Olivia had for teaching her students. Olivia’s larger goal was to expose her students to knowledge, perspectives, and experiences that would aid in building their agency to “thrive” in life:

You know, I just want... for me, it’s not about passing the GED, it’s not about enrolling in community college, it’s not about... it’s just like... you have more agency when you... when you feel better about yourself, and like... you have more leverage when you like know lots of different things. Like that’s important to know about different things.

Aside from issues of justice, Olivia believed it was important to provide her students with a deeper sense of how the world works in general for their own sense of self. As an example, she took them on a field trip to the Federal Reserve Bank to learn about how money goes through circulation and eventually dig deeper about where the idea of money comes from and how money works in society.

These lessons primarily took place either during special programming or in her reading or social studies lessons, and only through participation in CBMP did she realize that mathematics lessons could also be used to teach about the world and about injustice. Prior to the study, she had attempted a couple of mathematics lessons that were framed with real-world contexts, such as having students examine the correlation between local

high school attendance and graduation rates and having students learn about linear equation by investigating cell phone plans. However, neither of these issues was directly tied to social justice. She also admitted to having struggled with focusing on students learning mathematics because she would often get carried away in the discussion of the issues. For Olivia, participating in this study was an opportunity to plan together to make a stronger connection in her classroom between mathematics learning and learning about the world and its injustices.

### **Overview of Curriculum Design and Implementation**

The design and implementation of the social justice mathematics curriculum for each of the sites was different and depended on the constraints of the settings. At Hewitt, where Diana felt more constrained by curricular demands, Diana and I decided to focus on developing the 8<sup>th</sup> grade project together to be implemented in the spring semester. Because of the topic of my dissertation, Diana was inspired to make the project about citizenship. In terms of the mathematics component of the project, Diana wanted her students to learn about their city through mathematics. To make the project about an issue of injustice, we designed it around examining the disproportionately high number of vacant lots in the neighborhood of the school/students compared to other parts of the city. This involved three sessions in which students analyzed demographic data from ten zip codes in the city, then six sessions analyzing the distribution of basketball courts and vacant lots across these ten zip codes. These sessions did not occur consecutively; instead, Diana interspersed them across four weeks in order to be able to still generally follow the year's curricular calendar during non-project days.



At the LCLC, Olivia elected to embed social justice into a full year of mathematics lessons, which we commenced in the fall. In contrast to the work at Hewitt, at the LCLC there were multiple themes explored over the course of 29 sessions, which were implemented approximately once a week. The four themes are as follows: 1) wealth inequality, 2) bullying, 3) the dropout crisis, and 4) stop-and-frisk. Because the class makeup was constantly changing, the student participants in this study experienced these lessons with varying frequency. More information about the lessons at both Hewitt and the LCLC is provided in Chapter 6.

## **Data and Analysis**

### **Data Collection**

There are four main types of data I collected for this study: 1) teacher and student interview data, 2) teacher/researcher meeting notes and recordings, 3) class observation notes from each session, and 4) artifacts from class sessions. This study focuses on an analysis of student interviews to learn about their conceptions about citizenship, their conceptions about the role that mathematics plays in developing citizenship, and how these conceptions were affected by their experiences with social justice mathematics in their classroom.

The goal of understanding individuals' conceptions compels an interview format that allows interviewees to articulate their ideas freely in their own words and to guide the interview in directions that align with their particular views. Thus, although specific questions were formulated, the interviews were semi-structured, meaning that the questions were used as guides and follow-up questions were often prompted by the responses of the participants (Hammersley & Atkinson, 1995). In addition, interviews at

the end of the study were “tailored” to address questions pertaining to experiences of the participants that emerged over the course of their involvement in the study (Weiss, 1994, p. 51). Interviews were audio recorded with the consent of the participants for the purpose of capturing their ideas more accurately. Four participants, all from the LCLC, consented to be interviewed but did not consent to have the interview audio recorded. In these cases, notes were taken in a notebook during the interview, including capturing key phrases, to aid in producing a lengthier accounts of the interviews.

At the outset of the study, my intention was to interview each student participant twice at both settings. An initial interview before implementing the social justice mathematics curriculum would probe students’ conceptions of citizenship, mathematics, and relationship between mathematics and citizenship. A final interview after the curricular implementation would serve to gather information about students’ experiences with the curriculum and how these experiences impacted their conceptions. At Hewitt, I followed this protocol and conducted two interviews with almost every student participant. All of the participants were interviewed within a three-week time span immediately preceding the start of the project, and almost all were interviewed again after the project was over. Only one student did not have a follow-up interview because he sustained a major injury and missed the last weeks of school. At the LCLC, on the other hand, the logistics of coordinating a time to interview students individually during a session they were free in conjunction with the volatility of the program and students’ attendance made it difficult to implement the same plan. Instead, interviews were scheduled at some point after students began to participate in the social justice mathematics lessons, some early in their participation and some later according to

scheduling logistics. When possible, follow-up interviews were conducted in order to capture more reflections from students about subsequent lessons they experienced. In total, 17 students were interviewed; five of these students also had a follow-up interview.

Teacher interviews, teacher/researcher meeting recordings, classroom observation notes, and artifacts were used to document the process of creating the lessons with the teachers and the implementation of the lessons in their classes. At the beginning of the school year, I met with each teacher and conducted a semi-structured interview with each to learn about their backgrounds, their orientations towards citizenship and justice, and their goals for their students. I also collected process data from each research site. All planning meetings with the teachers were audio recorded and sometimes supplemented with written notes and lesson planning documents, and field notes from the class sessions were also written.

### **Data Analysis**

Understanding student conceptions of citizenship and the role of mathematics primarily involves an analysis of student interview data. All 57 of the recorded student interviews were transcribed (41 from Hewitt and 16 from the LCLC), and the handwritten notes were fleshed out for the 6 non-recorded interviews (2 of the 4 students who did not consent to audio-recording were interviewed twice). Coding the data was an iterative process. Overarching themes with regards to students' conceptions of citizenship and their conceptions of mathematics were found in the data, which guided the selection and creation of the frameworks used to ultimately categorize these conceptions. Further analysis yielded more detailed codes grounded in the data about the multiple ways that students' conceptions fit the frameworks. To analyze students' reflections of the social

justice mathematics lessons, interview transcripts were coded for how the students talked about the mathematics in relation to the context of the lesson (i.e., the issue being examined). The framework for analyzing student conceptions of citizenship was also used to code how students thought about how to address issues in their community and the issues that were presented in the lessons.

Teacher interviews were transcribed and perused to glean important information for the descriptions of the teachers provided in this chapter. Recording and notes of planning meetings were not used for this paper, but the lesson planning documents and field notes were helpful for constructing the timeline and details about the social justice mathematics lessons and projects that the teachers and I planned.

### **Researcher Positionality**

It is important to keep in perspective my identity and positionality in this study (Milner, 2007). As a racial minority and as an immigrant for whom the path to citizenship was not smooth, I do have my own direct experiences with the connotations of exclusion embedded in ideas about citizenship. I also speak Spanish, having lived my earliest school years in Chile after moving there from Korea, where I was born. Fluency with Spanish was useful during one student interview at the LCLC, as the student expressed she was more comfortable responding with a mix of English and Spanish. However, my life experiences are mostly different from those of the students and teachers in my study. As an Asian-American woman with middle-class upbringing, I am an outsider to the racial and cultural communities of both the students and the teachers in the study.

In my analyses of the interviews, I sought to be as true to the youths' voices and perspectives as possible, but inevitably my interpretations of their responses are limited because of my outsider status. In addition, as an adult, a partner to teachers, and as a researcher representing a university, I could be perceived as a figure of authority. Consequently, the youths may have intentionally or unintentionally applied filters or felt pressure to respond a certain way when speaking with me.

My relationships with the teachers were less hindered than with the students, as we had not only become research partners but had also built friendships and camaraderie through our mutual goals, our identities as educators, and as spiritual women of color. During our planning meetings, we often spoke about our personal lives, with Olivia in particular seeking my advice about applying to seminary school. However, the teachers' racial identities and backgrounds positioned them as part of their students' communities in a way that I could never be. Although we were collaborators in designing and implementing social justice lessons in their classrooms, the teachers' goals for and relationships with their students were distinct from my own. My interactions and relationship with the teachers were therefore also shaped by their perceptions of me as an outsider and as someone representing an institution of authority in terms of academic knowledge. While my positionality does not take away from the analysis I present, it is important to consider that the particular perspective I bring underlies all aspects of the research.

## **CHAPTER 4: STUDENT CONCEPTIONS OF CITIZENSHIP**

### **Introduction**

This chapter answers the first research question of my study: What are youth's conceptions about what it means to be a citizen? I addressed this question in two ways. First, I analyzed students' direct responses to questions about what they believe the role of a citizen is in their community or society. By allowing students to freely articulate their ideas, I attempted to capture the associations students made to the concept of citizenship. Second, I asked students to describe issues in their community that they wanted to be changed or different and to discuss how they believed these issues could be addressed. As I explained in Chapter 2, the reason for the second question is that addressing problems in their communities or society may or may not be part of individuals' conceptions of citizenship, but their ideas about how issues could be addressed can illuminate underlying beliefs about the role and power of citizens to shape their worlds beyond their individual circumstances.

Students' articulations of their conceptions of citizenship as well as their responses to addressing issues in their communities were categorized according to Westheimer and Kahne (2004)'s conceptions of personally responsible citizenship, participatory citizenship, and justice-oriented citizenship. Rather than being divided into three distinct categories, students' conceptions were layered across them. In other words, a student could simultaneously hold a view of citizenship as personally responsible for oneself on a day-to-day basis while also believing that one must enact a justice-oriented conception in the face of systemic injustices. At Hewitt, initial interviews served as the data source for the material in this chapter. At the LCLC, students were also asked about

their conceptions during their initial interviews, but for many this was their only interview.

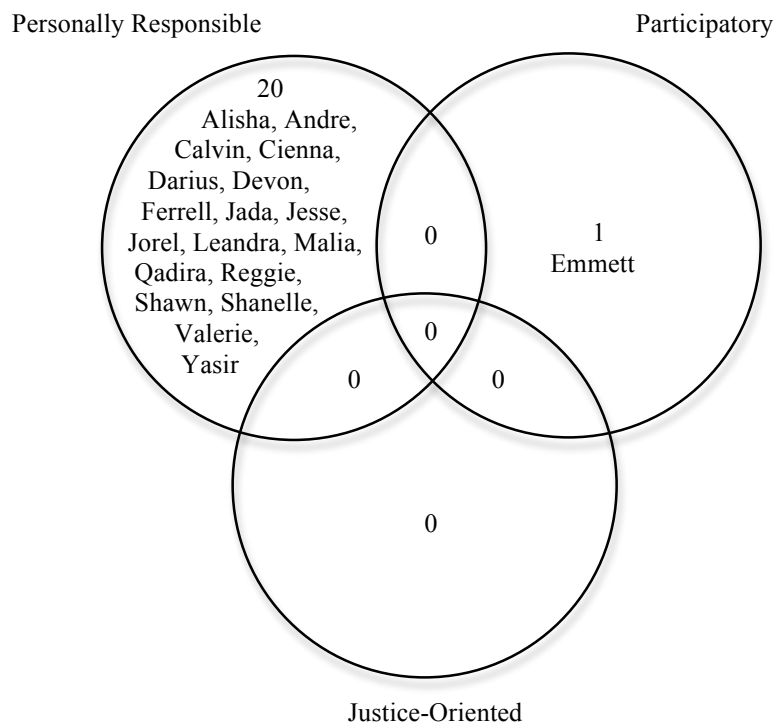
One aspect of citizenship that Westheimer and Kahne (2004)'s framework does not capture is that citizenship can also refer to legal status. For each of the research settings, I begin by addressing how students related citizenship to its legal connotations. Then, I go on to analyze students' conceptions of citizenship and their responses to issues in their communities. A comparison of the responses of the students in the two settings highlights the prevalence of personally responsible conceptions of citizenship across both settings while also illuminating the possibilities for educating youth towards justice-oriented conceptions.

### **Student Conceptions of Citizenship: Hewitt**

#### **Defining Citizenship**

*Formal citizenship.* At Hewitt, my intention of studying conceptions of citizenship in terms of what it means to be a member of one's community or society rather than in terms of legal boundaries was verbalized multiple times, both when the students were being introduced to the project and also when they were being interviewed. In fact, the students were reminded of this during the interview as they were being asked to describe what citizenship means to them. Despite these disclaimers, there were still several students who referred to citizenship in legal terms. Qadira was most direct, defining a citizen as "[s]omebody who lives here in America legally, has the rights to live here." Two other students (Ferrell and Cienna) both referred to criteria for being considered a citizen, namely being born in the United States.

Several students took an opposite approach and defined a citizen in terms of what one would be entitled to or have the rights to do. Darius said that being a citizen means “being able to vote and do taxes,” which could be alluding to one’s legal rights and obligations as a legal citizen. On the other hand, Yasir and Jada listed the freedoms that they believed a person is entitled to as a citizen, including the freedom of speech in addition to the right to vote, which refer to broader ideas of the rights of a human being. Finally, three students (Reanna, Reggie, and Shanelle) listed voting as one responsibility as part of their personally responsible conceptions of citizenship, which is further elaborated in the following subsection.



*Figure 2.* Categorization of student conceptions of citizenship at Hewitt



*Personally responsible citizenship.* All but one student articulated a definition of citizenship that aligned with personally responsible conceptions (See Figure 2).

Personally responsible citizenship consists of several interrelated dimensions, and the students' conceptions consisted of one to several of these dimensions. One of these dimensions was the idea that citizenship is about fulfilling standards of propriety or expectations (14 students). Most often, students referred to adherence to rules or laws and avoiding deviant behavior (10 students). For example, Calvin said a citizen acts like a "young man or a young lady," which means one does "not fight, not drop out of school, not get pregnant at a young age, not sell drugs, not smoke." The students also referred to fulfilling individual responsibilities by working hard (5 students). Andre considered himself a good citizen because he was a good student: "Because I listen, I do all my work in school, and I pay attention, and I don't let nobody get in my way of learning." A good citizen as an adult was described as someone who works hard at their job and pays one's bills.

Good behavior and hard work have to do with individuals' responsibilities to themselves, but personally responsible citizenship also includes an individual's responsibility to others. As many as 18 students described a citizen as someone who has a positive impact outside of oneself. Most (13 students) framed this role as fulfilling a responsibility to one's community by helping to maintain and improve it. Five students mentioned that a citizen helps to reduce violence in the community—or as several students said, they "stop the violence"—either by reporting the negative behavior of others or by trying to convince others not to engage in such behavior. Ten students said that citizenship includes helping to clean one's neighborhood and to maintain its cleanliness

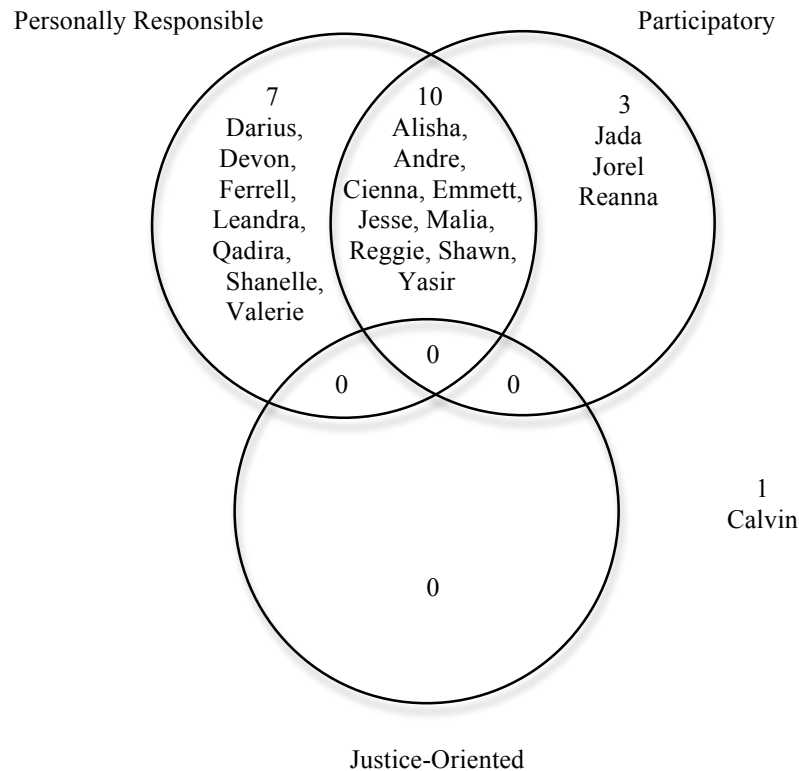
by not littering. Two of these students, Jesse and Rashida, went beyond the level of the neighborhood and talked about a citizen's responsibility to take care of the environment on a larger scale. Jesse expressed concern about not just littering but disrespecting the environment, like "throwing glass at trees," while Rashida also listed planting trees and cleaning oceans as actions of a citizen. Jorel summarized the attitude of a citizen as simply caring for the place they live: "A good citizen? A citizen that care, have responsibility, they care, they don't just... 'I don't care, I'm just living here to be living here.'"

Personally responsible citizenship is not only about fulfilling responsibility to oneself and one's community but also about cultivating good character. Eleven students described good citizenship as general goodness, whether in terms of performing good deeds like helping the homeless and assisting elders or exhibiting good personal characteristics, such as being a nice person or caring about others. Alisha described this goodness as coming from within the person: "A good citizen share and give and... I mean, some people would deserve for somebody to give back, but I think it's just the joy of giving too that makes them a good citizen." All of these dimensions align with personally responsible conceptions of a citizen as being an exemplary member of society, both in terms of actions and character.

*Participatory and justice-oriented citizenship.* Only one student's definition of citizenship was outside of the category of personally responsible citizenship. Emmett said citizenship means helping out, which he illustrated with the example of attending block meetings in order to resolve conflicts. This example reflects a participatory conception of citizenship because it is about engaging in a collective effort to improve the

community rather than an individual simply performing a good deed or exhibiting characteristics of a good person. There were no students whose descriptions of citizenship included any features matching a justice-oriented conception.

### The Role of a Citizen in Making Change



*Figure 3.* Categorization of student responses to issues in their community at Hewitt

In order to understand how the students at Hewitt viewed the role of a citizen in effecting change in one's community or society, they were asked to discuss issues in their community that they would like to be different. All but two students—Rashida and Yasir—named drugs, violence (including bullying, fighting, and shooting), and other crimes as the primary issues they faced in their communities. Six students—Cienna, Devon, Jesse,

Rashida, Shawn, and Yasir—brought up trash and litter in the community as problems. Most of the students' ideas about how to address these issues aligned with personally responsible approaches, but at the same time, talking about how these real-world issues might be addressed also brought out ideas that aligned with participatory conceptions. No students offered justice-oriented responses. Figure 3 illustrates the types of responses students provided. Note that one student, Calvin, offered no ideas for addressing issues and is represented outside of the categories.

Although all of the students except for Calvin offered responses about how to address the issues they named, it did not necessarily mean that they believed that addressing issues was part of the role of a citizen. In many cases, students placed the locus of responsibility to solve problems in their communities on external sources of power, such as law enforcement or government officials. Nor did offering responses necessarily mean that students believed that change was possible. This section elaborates on the variety of types of personally responsible and participatory responses that students offered as ways to address the issues their communities faced and how the students perceived these responses in terms of the role and power of citizens to make an impact. Whether and how the types of issue students were addressing factored in to how students responded is also discussed. Although no students gave justice-oriented responses, a subsection is included to discuss possible explanations for this absence. Finally, students' views of themselves as agents of change with regards to the issues are discussed to learn about whether students identify with the responses they generated.

*Personally responsible responses.* The nature of the issues that the students named reflects the personally responsible conceptions of citizenship that the majority of

the students held. Engagement with drugs (abusing or selling), violence, and crime are all easily identifiable as problems by students whose reigning notion of citizenship is avoidance of socially deviant behaviors. Similarly, the issue of trash and litter is a problem to citizens who place importance on physically taking care of their neighborhood environment. Whether students felt that personally responsible approaches to addressing these issues were impactful, however, depended on students' attitudes and ideas about individual change, and they also depended on the issues being addressed.

Seventeen students presented ideas categorized as personally responsible responses to addressing the issues they named. As stated earlier, all but two students (Rashida and Yasir) named drugs, violence (including bullying, fighting, and shooting people), and other crimes as part of the primary issues they faced in their communities. All 15 of these students put forth the idea of effecting change in the community by changing individuals' behaviors, whether by monitoring one's own behavior, influencing others, or both. Eleven of these students discussed the importance of attending to one's own behaviors. These students believed that change in the larger community happened as a result of individuals abstaining from deviant behaviors, ranging from choosing to walk away from personal conflicts to not engaging in crimes like selling drugs. One student, Shanelle, also argued that focusing on one's own behavior could influence others indirectly by setting an example for them to follow: "So it's like starting with yourself. When you do good yourself, people who see you will do the same thing and on and on." Six of the 15 students turned an outward focus on managing behaviors, stating that individuals can play a role in stopping the deviant behaviors of others. Some students described a mentoring role that individuals could take on to influence others not to get

involved in negative behaviors like fighting. Others described direct confrontations, like stopping someone who is about to commit a petty crime. Related to the latter idea was stopping others by appealing to external authorities, such as reporting crimes to the police.

The other type of personally responsible response that students described was taking care of the community. Jesse, Rashida, Shawn, and Yasir talked about the specific role a citizen has to help clean up the trash and litter in their community, or at least abstain from littering themselves. In addition, Yasir said that if people planted gardens it would make the community look better, while Rashida took an environmental perspective and suggested that individuals should plant trees and take care of nature. (Note that although Devon and Cienna also mentioned trash as an issue in their community, they did not discuss how they would address it and focused instead on issues related to drugs, violence, and crime).

*Participatory responses.* Discussing how to address issues in their community also brought out participatory responses. In fact, more than half of the students (13 of 21) proposed ideas that aligned with participatory conceptions. Personally responsible responses focused on the ways that people could improve their communities by acting responsibly and positively as individuals and influencing other individuals to also act this way; participatory responses consisted of ways individuals could engage in initiatives, either themselves or as a collective with others, to make change. However, in most cases, participatory responses were related to personally responsible responses, serving as organized or more formal ways of inducing good, responsible behavior or to report or prevent bad behavior.

In many instances, students' responses were participatory versions of influencing the behaviors of the people in their communities. Rashida and Yasir, who both focused on the issue of garbage and litter in their neighborhoods, suggested putting up flyers or posters admonishing people not to litter and to clean up their blocks. Jesse provided an example of a response from his own experiences: his block captain would organize a cleanup for the whole neighborhood. He also proposed that, as class president, he could organize a recycling program for the school. Cienna, Jada, and Reanna proposed organized efforts to help the people in their communities to avoid engaging in deviant behaviors. Cienna suggested that a program could be set up to facilitate conflicts between individuals to abate violent escalations, Reanna said groups could be organized to teach teens about violence, and Jada recalled the neighborhood putting together parties "to show the kids like there's positive things" and thereby "try to keep the peace." Jorel and Malia both mentioned neighborhood watches as a way to aid and facilitate reporting crime to the police.

Five students proposed means of voicing their concerns to government authorities like the president or the mayor. Andre, Shawn, and Jesse all mentioned writing letters asking them to do something about issues in their communities, and Alisha and Reanna suggested that people could hold protests. These suggestions were categorized as participatory because, unlike justice-oriented responses, they focused on addressing symptoms rather than the root systems. The students did not see these as issues of injustice but rather as ills to convince authorities to fix. For example, elaborating on what he would ask for, Andre specified that he would ask the mayor to "to put more cops on the street, more cameras out on posts."

Two students suggested participatory responses that had the potential for citizens to take action themselves. Emmett and Reggie both suggested that people could get together to talk about the issues and figure out ways to respond to them collectively. Both of these students mentioned the importance of block captains in leading up such efforts, and Emmett said that his parents attend block meetings where these discussions take place. These ideas could possibly lead to justice-oriented responses, but in themselves are participatory because they do not address systems of injustice. It is likely that Emmett and Reggie imagined these discussions to lead to the participatory responses that the other students came up with (i.e., distributing flyers, organizing block cleanups and neighborhood watches, creating groups to teach teens about violence). Emmett did not give specific details about what kinds of actions might result from discussing the issues, but Reggie said as an example that people could jointly file a complaint to prompt building managers to address issues in the housing projects most of the students lived in.

The participatory responses that the students suggested were ways in which citizens could actively engage in actions or initiatives to address issues in their community, whether in terms of drugs, violence, and crime or taking care of the neighborhood environment. These responses were organized means to either facilitate individuals in engaging in personally responsible ways (i.e., avoiding violence, cleaning the block) or to take up their concerns to people in power who could address these issues. Unlike personally responsible responses, however, the participatory responses provided avenues for individuals to contribute to making change beyond fixing one's own behavior or personally convincing another individual to do so. Many of the responses required



organizing a collective effort, though some were individual initiatives like writing a letter.

*Responsibility and power to make change.* Although most of the students at Hewitt did have a response for how the issues they named could be addressed, they did not necessarily consider it part of the role of a citizen to participate in addressing them. They also did not necessarily believe that change was possible with regards to these issues. Students' stances on these two dimensions (the locus of responsibility and belief in the possibility of change) are outlined in Table 7. An external locus of responsibility refers to relying on government or law enforcement to address the issue, while an internal locus of responsibility refers to relying on oneself as an individual to take responsibility.

Table 7

Locus of Responsibility and Belief in Change According to Issue

Locus of responsibility	Belief in change	Number of students
<u>Issues named: Drugs, violence, and crime, only</u>		
External	No	9
External	Yes	1
Internal or Both	No	1
Internal or Both	Yes	3
<u>Issues named: Physical environment included</u>		
External	No	2
External	Yes	0
Internal or Both	No	0
Internal or Both	Yes	4

Focusing on correcting individuals' behaviors did not garner much faith in the possibility of larger community or societal change for the students. Among the 7 students with only personally responsible approaches to issues of drugs, crime, and violence (namely, changing behaviors), only one student believed that change was possible. Ferrell relied on his belief in the possibility of individuals to change, stating that change can happen if people "set their mind" to it. The rest of the students expressed pessimistic beliefs about people's desires or abilities to change. They said that people will continue to engage in deviant behaviors, whether because they are "ignorant" (Leandra), they "don't care" (Devon), or they do it because they are trapped in a cycle of need and "it's like they have don't have no choice" (Shanelle). Two students who did not believe change was possible with regards to the trash and littering program in their neighborhood expressed being overwhelmed by the prospect of efforts in cleaning up trash when they knew people were going to continue littering. They also believed that the people who were littering were difficult to change because they already did not care.

A lack of faith in the possibility of change went beyond the students who only gave personally responsible responses, perhaps because many of the participatory responses were an extension of personally responsible ones. As evident from Table 7, more than half of the students (12 of 20) did not believe in the possibility of change. These students often attributed the primary role of making change to external sources of power and authority. Of the 12 students that said they did not believe that change was possible, 11 responded that while citizens can play a part in contributing to making change, the responsibility falls primarily to law enforcement or government officials (i.e., the mayor or president). In contrast, of the 7 students who did believe that change was

possible, all but one put the onus of making change on individual citizens, though sometimes in conjunction with governmental and law enforcement authorities. The one exception was Andre, who said primary responsibility fell on the president and mayor; but he also said that he could become president and mayor to address issues in the community, which, in effect, brings back the responsibility of making change on himself as an individual.

The casting of responsibility to external authority figures reflects a sense of general powerlessness in addressing issues in their communities or society. Moreover, the students who deflected the role of making change to these external figures demonstrated a further sense of powerlessness as they expressed a lack of faith in these figures to be effective. Valerie observed about the mayor, “Like he should do something about it, but it like... he's not really doing that much 'cause he's worried about other things.” Malia and Qadira revealed that despite students’ dependence on police to protect people and deal with crime, there was a tense relationship between the community and the police. Both students mentioned that sometimes law enforcement officials arrest people without a good reason, which Qadira said only contributes to a negative situation:

Sometimes all that they can do is lock people up, and that's just making people more worse, because they like why did you lock them up, they not doing nothing' so that's why people wanna be, you locked my cousin up, you locked this person, then you gotta lock me up, so I'm gonna do something bad. That's how it is around here.

Between feeling that changing other individuals’ behaviors is not in one’s control and relying on external sources of authority that they do not have faith in to advocate for their community, it is no wonder that many of the students at Hewitt did not believe that change was possible.

Despite this general lack of faith in being able to effect change, an important factor to note is that the ratio of students who believed change was possible to those who did not was higher among students who included or only named taking care of the physical environment as an issue for the community. As Table 7 shows, of the students who named taking care of the physical environment as an issue, twice as many said the responsibility was on citizens as opposed to external sources of authority, and these were the same students who believed that change was possible. What is not shown in the table is also that nearly all of these students (5 of 6) gave both personally responsible and participatory responses. This suggests that the issue matters in determining the types of responses students generate. In this case, taking care of the physical environment by refraining from littering, helping to clean up, etc. is likely a more tangible issue to address, one more easily handled by community members without external assistance, and easier to initiate efforts and organize around.

*Justice-oriented responses.* No students gave justice-oriented responses to the issues. The nature of the issues students mentioned aligned well with personally responsible ideas of citizenship, but they did not strongly conjure a sense of injustice. The students attributed a high engagement with drugs, violence, and crime and the volume of trash and litter in the neighborhood to the poor behavioral choices of individuals, not on systemic flaws or injustices.

However, there were some students who hinted at injustices as factors that contribute to the prevalence of the issues they named. As noted previously, Malia and Qadira both said that the police did not always have good reasons for arresting people, which Qadira believed only resulted in attitudes of defiance and increased negative

behaviors. However, these students may have only been pointing out poor practices of police in general rather than an issue of injustice where their particular communities are being targeted more than others. Reggie was most clear in pointing out an injustice embedded in the issues of violence in his community. As Reggie explained the important role of law enforcement, he opined that change was difficult to attain because the neighborhood was poor and could not choose to hire more police officers like others might be able to do. In other words, Reggie recognized an injustice in his community's access to resources. However, he expressed a sense of powerlessness about what he saw as an unfair situation:

Reggie: It's not fair. We should all have equal. We should be equal with our resources, not other people having more than what we have.

Vivian: So what can be done about this unfairness? Do you think somebody should do something about that?

Reggie: They should, but they really can't, because they don't have... well, our community only have a little bit of speaking what equal rights we have, so we really can't do nothing.

For the students at Hewitt, the issues in their community that were salient to them yielded mostly personally responsible responses, which led to a limited sense of power to make an impact. Furthermore, even Reggie, who recognized an injustice, pointed to a cycle of hopelessness: A lack of power to make change as individual citizens meant relying on external sources of power like the police, but the lack of power also left citizen unable to address the unequal access to this source of power.

*Students as agents of change.* Students' lack of faith in the general ability to make change regarding the issues in their communities they named reflected on their own sense of power and how they viewed their own role in the community. Eight of the students who did not believe that change was possible also said they did not see a role for

themselves to address the issues aside from being personally responsible themselves, and similarly, four of the students who did believe in change also believed in their own power to make a difference. However, the remaining four students who believed in change did not believe they had a role to play themselves. Jorel said that reducing violence was possible, but he added the caveat that it would require a great deal of work by the police, while he himself was unable to stop people from engaging in violence. The other three students—Emmett, Jesse, and Reggie—said they could play a role in the future but their present focus on schooling prevented them from being able to engage in the present moment. Reggie in particular expressed a sense that he lacked the knowledge necessary to be effective: “Right now, no, but in the future, probably because I would be more smarter and more experienced on stuff like this, and I probably could help out and make a difference.” On the flip side, three students who were skeptical about the possibility for issues related to drugs, violence, and crime to be addressed in their neighborhood expressed that they believed in their own power to make a difference. However, one of these students, Shawn, was unsure of what role he might play to enact his power: “Mm... I don’t really know, I just think that I do [have power]. I don’t know how.” The other two students, Jada and Valerie, focused on their personal ability to affect other individuals positively through their own positive actions and messages despite their lack of confidence that the larger issue in the community could be resolved. Overall, students had difficulty articulating the specific roles and actions they could take to address the issues pressing them most in their communities.

## **Summary**

Personally responsible conceptions were overwhelmingly dominant in students' own articulations of what it means to be a citizen. Discussing how citizens can take part to address issues in their own communities, however, brought out many ideas that align with participatory conceptions. Having ideas for addressing issues did not necessarily mean though that students believed these ideas were effective or even part of a citizen's role. Most of the students had named drugs, violence, and crime as the issues most affecting their communities, and they overwhelmingly felt powerless to stop them, particularly the students who gave personally responsible responses that relied on believing that individuals will change their own behaviors. A majority of the students said that external sources of authority, like law enforcement officers and government leaders, were in charge of dealing with these issue; though almost all of these students believed that change was not possible, many citing distrust in authorities to take action on behalf of their community. The students who were most likely to believe that change was possible were ones who named taking care of their community's physical environment as an issue, a more tangible and specific issue for citizens to tackle without external intervention. Although there were some students who hinted at issues of injustice in their community, these issues went unaddressed.

### **Student Conceptions of Citizenship: The LCLC**

In the following sections, I outline students' definitions of citizenship and their responses to issues in their community at the LCLC. One thing to note is that because the students at the LCLC were interviewed at inconsistent times relative to their participation in the study, the interview questions were less clearly defined. Also, the interviews at the

LCLC occurred over a span of almost an entire year, and some of the interview questions evolved over this time. Although all students were asked about their conceptions of citizenship, I was not consistent in clarifying to students that by citizenship I meant a member of society rather than the legal term. In addition, four students were not asked to talk about issues relevant to their communities (Bianca, Lara, Lisa, and Shaquan); this was a question that was developed after these interviews took place in November, when I realized that only asking students to define citizenship was insufficient. Moreover, one student, Xavier, was interviewed after substantial exposure to social justice mathematics lessons, so his interview was focused on his reflections in the class rather than on issues in his community outside of the class topics.

### **Defining Citizenship**

*Formal citizenship.* The strong association of the word citizenship with legal status was apparent in the students' responses at the LCLC. Out of the 8 students who were first asked to define citizenship without the researcher's qualification of its meaning as an individual's role in the community or society as opposed to legal status, 6 immediately responded with a statement related to legal status. The types of responses varied. Lance and Xavier acknowledged legal standards, though they were not accurate (Lance thought one had to be born in the United States, while Xavier conjectured that someone could become a citizen after residing in the country for 31 days). Wesley referred to having a social security number as an aside after stating that citizenship is having pride in where one lives and is from. Felipe, Isaiah, and Wendy actively resisted the legal definition. Isaiah and Wendy both emphasized attributes as making a citizen regardless of immigration status, while Felipe pointed out the irony that many people



who aspire to acquire legal citizenship status have difficulty doing so while most people who already hold this status are not knowledgeable about the government.

The salience of legal status as part of student's conceptions of citizenship was also made apparent by the fact that even students who were told explicitly that the interview was not about citizenship as legal status still included or alluded to it. Zohelia associated citizenship with pride because "not all people could be here," and she expressed relief that she herself did not have trouble with immigration. Although her response does not explicitly mention legal status, it is tied up with ideas about the difficulties of being allowed to immigrate to and reside in the United States. Bianca included knowledge about the process of naturalization as an important part of what a citizen should know, and along with that statement added that her boyfriend considers himself to be a citizen because he was raised in the United States, voicing her opinion that people should not judge others based on where they are from. Raul, reflecting on the class, said that he used to think that citizenship only referred to legal aspects: "The way I thought about it before is 'Hey, get away from here, get out of here!' That's what I like thought citizenship was." Raul's statement clearly shows what is hinted at in the defensiveness of many of the responses of his classmates. For these youths, citizenship was strongly associated with exclusion.

Aside from legal status, students also linked formal responsibilities to citizenship. Two students, Isaiah and Raul, mentioned paying taxes as part of citizenship. These two students also mentioned voting, though they held different ideas about its relationship to being a citizen. While Isaiah rejected voting ability (as a proxy to legal citizenship status) as indicative of true citizenship, he did mention electing a president as part of

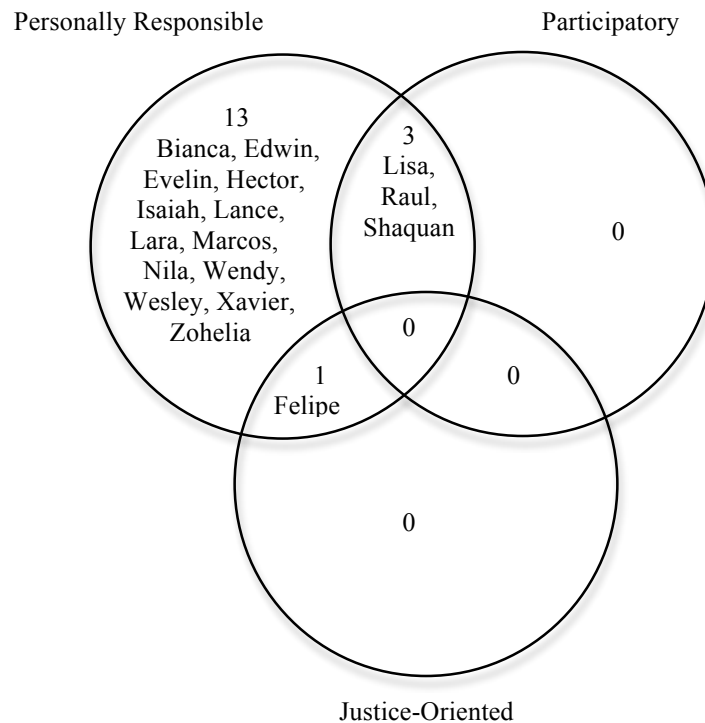
enacting one's citizenship. Raul, on the other hand, in evaluating himself as a citizen, considered it inconsequential that he had not participated in voting because he lacked faith in the power of voting: "I don't see the reason for voting at all. We're probably going to get another bad president." A third student who talked about voting was Wendy, who stipulated that voting is only meaningful if the voter is knowledgeable:

You're a good citizen because you vote. No [Laughs]. It's not because you vote, I could care less if a person votes really. I care about why he's voting, not because he votes. Why are you voting? Are you voting just because you have the right to? Are you voting because you really know?

Like legal status, students viewed voting critically as a formalized action with no inherent power or meaning behind it.

Finally, some students talked about citizenship in terms of rights. Felipe and Zohelia emphasized freedoms as being at the core of citizenship, such as the freedom of speech and the freedom to pursue any career, which they noted was not necessarily guaranteed elsewhere. Other students took up the idea of rights and freedom from a liberal framework. Bianca and Xavier defined citizenship in terms of autonomy and individuality; they both defined a citizen as being true to oneself.

*Personally responsible citizenship.* The students were asked to go beyond legal definitions of citizenship and to consider what it means in terms of the role a citizen plays in one's community and society. In their definitions, all students expressed, in some form or another, personally responsible conceptions of citizenship. Figure 4 details how students' conceptions were layered across the three categories, with an overwhelming proportion of students expressing solely personally responsible conceptions.



*Figure 4.* Categorization of student conceptions of citizenship at the LCLC

Students' ideas about what it means to be a personally responsible citizen were similar to those at Hewitt. All but two students mentioned that citizenship entails a certain level of adherence to societal standards of propriety or expectations. This included fulfilling obligations, such as obtaining employment, working hard, and paying one's bills (10 students); as well as avoiding deviant behavior, such as substance abuse, violence, and breaking the law (9 students). Some students also associated one's mentality with propriety, such as having "a good head on your shoulders" (Isaiah) and a "right mind state" (Edwin). One student, Evelin, had a more outward focus, defining a citizen as someone who becomes a good role model for others by achieving success for

themselves. Unlike the students at Hewitt, working hard was not only seen as the proper behavior of a citizen, but also as a means towards self-respect and self-actualization. For example, Bianca said she wanted to get an education to be proud of herself and so that others would not be able to call her a “hoodrat.” Zohelia expressed an appreciation for the privilege of being able to live in the United States by making the most of these opportunities by “echando pa’lante,” or moving forward and accomplishing things.

Another idea that falls under personally responsible citizenship is that a citizen is a good person and a good neighbor. This idea extends beyond the self to conceptions about how a citizen relates to others. Nine students made the statement that a citizen helps people. The idea of helping varied from sweeping a next-door neighbor’s front stoop to talking to troubled youth in one’s community. Some of these students described helping as part of the nature of a good citizen, not just an action a citizen performs. Wendy said a citizen genuinely cares about others, and Lara stipulated that a citizen’s actions must come “from the heart.” A specific action that as many as 7 students named as part of being a good neighbor was taking care of one’s neighborhood physically by helping to maintain its cleanliness. Cleaning the block was portrayed as an extension of being a responsible, helpful, and caring individual. For example, Wendy upheld her mother as fulfilling her role as a citizen by taking it upon herself to clean up trash and hose down her block.

*Participatory citizenship.* Three students described participatory roles of a citizen in addition to personally responsible roles, and all three mentioned the importance of attending meetings as part of one’s role as a citizen. The student described these meetings as gatherings to organize events in the community, most commonly related to

cleanup. For example, Lisa described a woman in her neighborhood as the ideal citizen because she not only was the “sweetest person” (personally responsible), but she also took initiative to organize block meetings, block parties, and organize her neighborhood to participate in the “cleanest block” contest. Lisa distinguished between people who are and are not involved in these types of local efforts: “If you’re not a part of that, I don’t think that’s being a citizen. I think you’re just living there.”

Like personal responsibility, for the students at the LCLC, participatory citizenship was more than just about actions. Lisa and Raul conveyed a larger idea of a citizen as an invested member of the community. Raul emphasized the importance of knowing the people living in one’s neighborhood, expressing pride that he was familiar enough with his neighbors to be able to personally tell them to pick up their trash. Lisa described a sense of belonging at the center of one’s neighborhood investment: “Because it’s just like a bond that we have as a block, we gonna protect our own.” For these students, participatory actions were intricately linked to their strong ties to their communities.

*Justice-oriented citizenship.* Felipe was the only student to express ideas of justice-oriented citizenship in his definition. As mentioned earlier, freedom was at the core of Felipe’s conception of citizenship. Felipe explained that this freedom was not guaranteed, and he went on to discuss how part of citizenship is defending that freedom for everyone.

- Felipe: We do so much all together, you know, like a union, we all gather up, we’re all together in this, we’re all in it together in the long run, and nobody should be left out. There’s kids that like right now need their books, their schools are closing down.
- Vivian: What should people do?

Felipe: What people have been doing for the last thousands of years. Protests. For real. Making an act. Let it be known. That's how laws get passed down, people complaining and fighting for, like, women's rights, to hope, and all that like that, being able to vote.

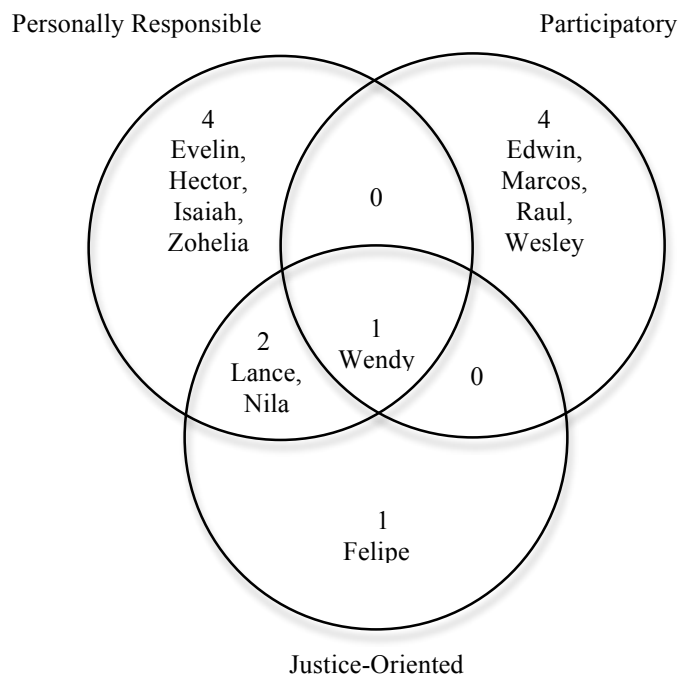
For Felipe, it was not enough to gather as a community to address symptoms in one's neighborhood, such as trash. Instead, he named both local issues (schools closing down) and larger, social issues (i.e., women's rights) as examples of injustices that people must come together to fight. Attending meetings, for Felipe, was an avenue towards such an action.

### **The Role of a Citizen in Making Change**

Although only Felipe talked about fighting and making change in the face of injustices as part of his definition of a citizen, he was only one of many students to talk about addressing issues affecting their communities in general. The difference is that although other students did also describe how a citizen might act to address these issues, their ideas were not necessarily tied to their conceptions of citizenship. Instead, these ideas surfaced in other parts of the interview when the researcher asked the students to talk about issues in their communities.

In the interview, 12 students discussed issues pertinent to their communities and the role of a citizen in addressing them, and all but two of these students named issues related to drugs, violence, and crime. Felipe and Wendy were the two exceptions, who named other, more specific issues, including school closings in the district—a current and pressing issue at the time. In addition, Nila and Lance, two of the students who named drugs, violence, and crime, also talked about school closings but as part of digressions during the interview.

Although not all of the students believed that addressing issues in their community was part of the role of a citizen, they came up with ideas about how they could be addressed. This section describes the various ways that students talked about the role of a citizen in addressing issues using Westheimer and Kahne (2004)'s framework. Generally, the responses of the ten students who talked about issues related to drugs, violence, and crime were categorized as either personally responsible or participatory approaches. The four students' responses to the issue of school closings and other specific issues provoked justice-oriented ideas. The breakdown of the students' responses can be found in Figure 5.



*Figure 5.* Categorization of students' responses to issues in their community at the LCLC

In contrast to the students at Hewitt, most of the students at the LCLC did not name external sources of authority as holding the primary responsibility for effecting

change. Therefore, rather than a separate subsection devoted to how students located responsibility in relationship to how talked about the possibility of change, these ideas are integrated into each of the subsections on the categories of responses according to conceptions of citizenship, though a subsection on students' sense of themselves as agents of change is included.

*Personally responsible response.* Students had various ideas about the role of a citizen in addressing issues of drugs, violence, and crime in their community. Six students conveyed that change in one's community happens through individual change in behavior, whether focused on oneself or on influencing other individuals. Hector and Zohelia described making change as individuals controlling their own actions and interactions with others. They proposed that to reduce violence, people could handle and prevent conflicts by choosing to talk about it. Isaiah and Nila also focused on individual behavior, though more generally. Nila said people should realize that they can have a second chance to turn around and make different choices for themselves, while Isaiah said that change could occur "if everybody was thinking the same and was motivated to do the right thing." In all of these cases, the idea being put forth was that an accumulation of individual efforts to change one's behavior would amount to a change in the larger community. Isaiah expressed pessimism about the viability of this idea, however, because he believed that too many people are "stuck on themselves."

Four students—Evelin, Hector, Isaiah, and Lance—talked about making change in terms of influencing other people, including individuals already committing acts of violence and crime as well as youth who are in the midst of making decisions about the direction of their lives. Isaiah displayed optimism about the prospects of influencing



others as a means to contribute to change, citing the strong influence that friends can have over one another. The others did not express much faith in such an effort, nor did they see it as part of the role of a citizen. Interestingly, all three used the phrase “stop the violence” without elaboration about what this means, and they conveyed a sense that making change was overwhelming and out of one’s control. For example, when asked to explain what it meant to “stop the violence,” Evelin replied, “I’m not sure, ‘cause it’s too many,” and later commented that getting involved in making change might not be fruitful because “some people won’t listen” and are “disrespectful.” Lance talked about his own efforts to guide youth as being inconsequential because “they think it’s just another person preaching.”

*Participatory response.* The four other students who talked about drugs, violence, and crime—Edwin, Marcos, Raul, and Wesley—all described participatory ways of addressing these issues by coming together to reduce their manifestations. Like at Hewitt, these were participatory ways to address the symptoms of the issues, mainly by finding organized ways to influence or control individuals’ behaviors. On the more formal side, Wesley suggested that people become involved in “organizations that do stuff,” citing as an example a program in which he participated that brings together youth to talk about issues affecting them like drugs and bullying. Marcos talked about the role of citizens to attend and speak up at community meetings in order to give attention to important issues: “Eventually, if I speak up, one of my friends is gonna speak up, and one of their friends is gonna speak up, and eventually you’re gonna have the whole community speaking up about one subject.” Marcos believed that by coming together, the community could collectively have the power to address an issue, such as by building

a recreation center to keep youth occupied when out of school. Edwin gave an informal version of Marcos's idea of speaking up; although he did not specify about speaking up at an organized event like a community meeting, Edwin emphasized the importance of voicing one's concerns in order to start a "chain reaction." Raul recounted a story of an informal collaboration among his neighbors to report to the police the issue of unruly behavior in the community's baseball field after failed individual attempts to arouse a response.

Like the personally responsible ways to address the issues in the community, ideas about participatory responses were also often accompanied by an attitude of defeat. Marcos and Edwin echoed Isaiah's sentiments that individuals are too worried about themselves to become involved in addressing issues outside of themselves. Marcos was compassionate, sympathizing with their struggles to take care of themselves. Edwin, on the other hand, expressed the more cynical view that people are "self-centered." Wesley even doubted the effectiveness of the program he himself had participated in because, like Lance and Nila, he saw people as unreceptive to address change in themselves. According to both Edwin and Wesley, addressing issues was primarily the responsibility of government officials, like the mayor, though Edwin was highly skeptical of their effectiveness as well.

*Justice-oriented response.* Four students—Felipe, Lance, Nila, and Wendy—brought up issues other than a general reference to drugs, violence, and crime. The nature of these issues were decidedly different; instead of naming and portraying issues as vices in the community that must be corrected, the examples that these four students brought up were about ways in which the people in the community were not being served

and ultimately being treated unjustly. As a result, while the personally responsible and participatory responses dealt primarily with trying to reduce the manifestations of issues, the responses in this subsection are characterized by trying to change decisions at the level of systems or government. This subsection focuses on three of these students. The fourth student, Wendy, is highlighted in the following subsection as an example of someone with complex conceptions of the role of a citizen in making change, which includes a justice-oriented conception.

As described previously, Felipe had articulated his stance that citizenship is characterized by fighting for rights and freedoms, such as women's rights and voting rights. His stance also applied to smaller, more local issues as well. Felipe touted the importance of protests, fights, and attending meetings so that people can "do what they can, not even if it's for the state, you know, at least for your community, you know? Get something going." More specifically, Felipe brought up the issue of the impending school closings in the city as an example of a local issue that invited action. The issue was directly relevant to his family, as his younger brother had brought home information about the city's decision to shut down his school. Felipe recounted urging his stepmother to voice her opposition to this decision as well as reading about people fighting against the school closings, and he linked these actions to his conception of what it means to be a citizen: "And then next thing you know, like... I see pictures in the newspaper with people actually protesting, doing something about it. That's... that's what... that's the citizen's definition right there."

Nilá and Lance were two students who described personally responsible approaches to addressing issues related to drugs, violence, and crime; however, both

talked about the issue of school closings during their interviews and offered an entirely different perspective about effecting change. Neither Nila nor Lance brought up the issue of school closings as part of their discussion about the role of a citizen. Nila brought up the school closings as something she had been following, and she expressed her opposition to the closings because she felt it was detrimental to the education of the city's youth. When asked to reflect on what could be done, Nila mentioned protests that were already happening. She was asked directly whether she believed these types of actions were part of the role of a citizen, and she replied affirmatively. Her response represents a divergence from her ideas about making change by changing oneself. Lance began to discuss his views about school closings as he was explaining his views about the importance of schools. He, too, cited the protests that were taking place, which he had witnessed live when he had visited the board of education building to sign up for a GED examination. Lance was supportive of the protests, marveling especially at the fact that he saw young people involved in them, but unlike Nila, he did not consider these actions as part of citizenship. Regardless of their stances on the role of a citizen in making change or addressing issues in their communities, talking about specific issues of injustice prompted these two students to consider justice-oriented approaches to addressing them.

*Complex conceptions: The case of Wendy.* As demonstrated by Nila and Lance, students' ideas about the role of a citizen as an agent of change were not necessarily confined to one dimension or category. Wendy is a prime example of someone who held a complex, multilayered conception of the role of a citizen in making change. Wendy also stands out among her peers because of her participation in a youth organizing and

advocacy program at her high school in the past. This program, with chapters in several high schools in the district, brought students together to organize around issues affecting their schools and communities. Although traditional schools had failed Wendy, she described her experiences with the youth advocacy program positively. Through it, Wendy had been involved in investigating the issue of increased high school dropouts resulting from harsh rules around truancy, participating in a press conference with the mayor in which the youths voiced their concerns. She said she also helped to oust the superintendent, who the group felt was doing a poor job of improving education in their city.

Likely because of her experiences in the youth organizing and advocacy program, Wendy was more prolific than her peers about naming specific issues she felt were important. She gave examples of the ways that people in the community suffered and could be helped, distinguishing them from issues that she felt were less consequential.

I'm tired of seeing them fix the sidewalks. Like, you're spending money on fixing the sidewalks when you could be spending money on better housing for these people, better schools for these people. No you want to make the sidewalk bigger. Now how about the single mother that's struggling with her house because she's waiting for Section 8 to come through . . . All the money you're about to spend on Pep Boys, Save-A-Lot, and all that, you could put to better textbooks. Better, as a matter of fact, build up the community center that would help the single mothers. More GED classes, more parenting classes, anything to really help. Start doing job fairs, like you could have built a job fair, start handing out jobs.

As she elaborated about the city's financial management, she also brought up the city's decision to cut funding for schools. All of these examples reflect Wendy's strong sense that the community or society is shaped by decisions and policies that are alterable. In spite of her references to a vague "you" as the decision-making body, asked what it

would look like to make change with regards to these issues, Wendy put the onus on both the government as well as individuals, or “we”: “Like, [the mayor]’s not going to do much unless we stand up for it. One, we need money to do the things we want to do. He has the money... but we need to stand up against him, otherwise he’s not going to do nothing. He could care less.” Wendy implied that individuals, the citizens, had an important role in making change by fighting against a government and system that was not representing their interests.

Although she expressed strong feelings about how change depends on individuals voicing and fighting for it, Wendy expressed that change can also happen through personally responsible ways. She went on to explain that if an individual carries oneself properly, working hard and focusing on school, then others will follow suit and be influenced to do the same. Wendy also gave the example of her aunt who not only volunteered at a food shelter but also took it upon herself to help hungry drug addicts to get clean and find employment. By providing a range of actions that people could take to initiate change, Wendy emphasized that what is important is for people to make an effort, no matter how small, to not be apathetic and ignore what is happening around them, even if they were not the cause. She explained this view through a metaphor: “Like, you see, it’s like a gum stuck on the bottom of your shoe. You know you stepped on gum because someone threw the gum there. So now you stepped on the gum and now you gotta deal with the gum on the bottom of your shoe collecting all the dirt.” Wendy expressly separated the definition of citizenship from the idea of being required to be involved with formal institutions, even if to fight against them:

They make citizenship real, they make it too messy. Oh you're only a good citizen if you're here legally. No. Oh you're only a good citizen like if you go to City Hall every day and sit in meetings and watch the mayor's office. No. Like there's, I think people are losing grasp of what's a good citizen and there's this thing, the technical standpoint of it. And I believe like that's what the president mean when they say 'good citizen' – person that's involved in politics is a good citizen. No.

Wendy valued her experiences engaging with the political and vocalized the importance of acting on issues of injustice. However, her strong desire of inclusivity around the label of a citizen led her to support a wider definition of a citizen as someone who simply cares about where they live, even if it only leads to personally responsible citizenship.

*Students as agents of change.* Despite the range of ideas students gave about the ways a citizen can make change, most of the students did not embrace the roles for themselves. The six students who gave personally responsible approaches to addressing issues of drugs, violence, and crime saw their own roles as limited to maintaining themselves and hesitated on their role of influencing others. Some, like Hector, Evelin, and Nila outright stated their self-prioritization over others. Hector, for example, said that despite believing that it is the role of a citizen to “stop the violence,” he himself would not diminish attending to his needs for the sake of others, whom he saw as responsible for their own actions and attitudes. Nila and Evelin were not necessarily opposed to going outside of themselves, but they felt it came second to taking care of oneself, which already took up all their time and effort.

In addition, students expressed a sense that they lacked the power to make change, even if they did make an effort. Evelin explained that she is quiet, usually at home, and does not have many friends, rendering her incapable of influencing others. Hector, on the other hand, said that the power to change was within other people

themselves and therefore outside of his control. This sentiment of lacking power to change other individuals was echoed by Zohelia, who was open to trying to influence others but was not convinced about its effectiveness. Only Lance and Isaiah expressed any sense of optimism that they could influence others, but they were limited to family and friends. With regard to the issue of school closings, Lance explained that he would consider participating but felt unconfident about his knowledge about the issue.

Students' focus on themselves and their sense of powerlessness to effect change was even expressed by Marcos and Felipe, who had articulated participatory and justice-oriented conceptions of citizenship. Both students expressed unwillingness to fulfill what they had described to be the role of a citizen. Despite touting the importance of getting people to voice the issues that bother them, Marcos said he chooses not to get involved, and he shifted his perspective about what it means to make change to a personally responsible one as he explained that one of the reasons he does not get involved is because he does not want to interfere in other people's business: "But if I don't know you and you doin' something, that's your business, not mine. I just keep moving." In addition, Marcos felt at a loss as to what he himself could do, saying, "I wouldn't even try to stop it [violence], 'cause I know I'm not gonna be able to do it." Felipe reacted similarly when asked about his personal role as a citizen. Whereas he focused on fighting for justice on both local and societal scales when discussing what it means to be a citizen, Felipe applied a personally responsible conception to himself, declaring himself as fulfilling the role of a citizen because he refrains from "disturb[ing] the peace" and is "not a menace to society right now." When this discrepancy was pointed out to him,



Felipe gave the same line of reasoning as Evelin—that he did not feel he would be able to fight for change because “you need more to stand strong.”

Edwin, Wesley, and Wendy were the only students to envision a role for themselves in addressing issues in their community. Edwin and Wesley had participatory responsible approaches to addressing issues of drugs, violence, and crime in their community, and they applied these approaches to themselves. Edwin referred to finding a program that helps people who need support and benefits the city. Wesley, as mentioned earlier, talked about how he had volunteered in a support group for youth, although he was pessimistic about its effectiveness. He said that when he became a coast guard in the future, he could help by patrolling the border for drugs. On the other hand, Wendy saw herself alongside all students as playing an essential role in enacting change. Although she insisted on including a broad range of ways of enacting citizenship, she proposed that schools should emulate the justice-oriented approach of the youth advocacy and organizing program in which she participated. Wendy saw schools as an ideal place to empower students to learn about and become involved in issues that matter to them and their communities, thereby positioning youth as key players. Drawing on the rhetoric of the organization, she posed, “Because if it doesn’t start with us, where is it going to start?”

## **Summary**

Like at Hewitt, personally responsible conceptions were also dominant in students’ descriptions of what it means to be a citizen at the LCLC, but some students also included participatory ideas and one student articulated a justice-oriented conception. In addition to demonstrating a broader range of conceptions of citizenship,

the way students at the LCLC talked about citizenship was more meaningful. Personally responsible citizenship was not just about meeting societal standards of propriety and responsibility through good behavior and hard work; it was also about achieving internalized goals for accomplishment and self-actualization. The responses categorized as participatory were not only actions; they were intricately tied to students' strong connections to their communities. Finally, Felipe's justice orientation was an extension of his definition of citizenship as freedom. The idea of freedom as part of citizenship was mentioned by several students at Hewitt as well, but Felipe made it more real, meaningful, and relevant to people's lives by talking about freedom as being continually struggled over in order for all people to attain.

The students at the LCLC also had a similar tendency as those at Hewitt to name issues related to drugs, violence, and crime when asked about issues in their community. Unlike students at Hewitt, only two students at the LCLC brought up external sources of authority as having the primary responsibility to address these issues, but they still had a generally pessimistic outlook on the effectiveness of the personally responsible and participatory responses they generated. Several students at the LCLC also brought up a more specific, current issue—the closing of public schools in the district. Although the students at the LCLC were not attending public schools themselves, the issue mattered to them because it affected their communities and sometimes their families. In addition, Wendy named a plethora of injustices she saw in how the city manages its budget. These students gave justice-oriented responses to the issues, many citing examples of actions they witnessed.

Wendy is also a notable example because of her past participation in a youth organizing and advocacy program at her former high school. Wendy was one of few students who saw herself along with fellow youth as powerful agents of change. While she insisted on an inclusive definition of citizenship that could be met by fulfilling any of the three conceptions of citizenship, she also expressed a belief that the approach of youth advocacy was an ideal way to empower students through their learning in schools.

### **Learning from Student Conceptions of Citizenship Across Cases**

Looking across the two cases leads to the idea that for the students in my study, citizenship was primarily associated with exclusion. At both settings but especially at the LCLC, some students gravitated towards defining citizenship in terms of legal status, even when explicitly told otherwise. The ways in which various students at the LCLC defended an inclusive definition of citizenship were reactions against the exclusivity of the terms of legality. But even beyond citizenship in terms of legal definitions, the dominance of personally relevant conceptions of citizenship served to exclude youth from fully participating as members of a democratic society. In this section, I discuss how the students were educated towards personally responsible conceptions, which were limiting in granting them the power to make change beyond their own individual lives. I then look across the two cases to discuss the possibilities of educating youth towards justice-oriented conceptions to open up new avenues to empower youth as citizens.

### **The Dominance of Personally Responsible Conceptions of Citizenship**

The clear prevalence of personally responsible conceptions of citizenship across the two settings reveals that whether part of the planned school curriculum or not, a particular form of citizenship education is taking place. At Hewitt, messaging that is in

line with personally responsible conceptions of citizenship was evident. As mentioned in Chapter 3, the daily morning pledge that students recited each morning in place of the pledge of allegiance—in other words, as an alternative to a patriotic act to signal one’s membership and loyalty to the political body—was the statement, "I am respectful, I am responsible, I follow rules and I am a positive role model.” The anti-bullying program held school wide, which consisted of talks about bullying during the students’ advisory period, was a constant reminder to students that they should not engage in violent and abusive behaviors. Diana’s relationship to her students as a mother figure that focused on teaching them to “control your life through informed decisions and responsible actions” also aligned with personally responsible notions. Given these circumstances, it is no wonder that nearly all of the students at Hewitt articulated personally responsible conceptions of citizenship.

But even at the LCLC, although there was greater diversity in students’ conceptions, personally responsible notions prevailed. Unlike at Hewitt, factors at the LCLC could not explain the convergence of students’ conceptions, since most of the students at the LCLC had only recently enrolled in the program. The prevalence of personally responsible conceptions across both settings means that the students were receiving a rather uniform education about citizenship. Whether from schools, home, the media, popular rhetoric about citizenship, or a combination of these sources, the students had learned that being a good citizen means following rules, abstaining from deviant behaviors, demonstrating good character, and being a responsible, productive member of society.

Focusing solely on personally responsible conceptions resulted in students feeling limited in being able to make change outside of themselves. This was especially disempowering for the students at Hewitt, many of whom cast the burden of responsibility on external sources of authority, even though they did not express having faith in these figures to work on their behalf. At the LCLC, only a few students mentioned the responsibility of authority figures. On the one hand, this could signal a greater sense of empowerment for citizens as the primary agents of making change. On the other hand, it could signal a similar lack of faith in these authority figures but a more decided non-reliance on them. In either case, coupled with personally responsible approaches, the students at the LCLC, too, were left with little hope for making change outside of their own individual stations in life. In fact, it is an orientation towards seeing problems through the lens of personal responsibility that may have been a key factor in prompting students to name drugs, violence, and crime in their community as the primary issues their communities were facing.

### **Possibilities for Educating Youth Towards Justice-Oriented Citizenship**

Despite the prevalence of personally responsible conceptions, shifting from defining citizenship to talking about the real issues that the students' communities faced revealed a potential to broaden students' ideas about citizenship. At both Hewitt and the LCLC, naming ways to address issues brought out participatory and, at the LCLC, even justice-oriented ideas. Students' ideas for participatory responses were more promising than personally responsible ones in that they named actions or organizations that individuals could partake in to effect change. However, often, these actions and organizations were participatory means of influencing or controlling individuals'

behaviors, which also yielded feelings of powerlessness and hopelessness in the ability for the issues to see change. Whereas students at Hewitt only stated this lack of faith, at the LCLC, some students spoke from personal experiences participating in such organizations, such as programs for youth to discuss issues like drugs and bullying in their lives. On the other hand, when students at the LCLC named justice-oriented responses to tackle issues like school closings, there was not the same sense of hopelessness. Even though most of the students were not necessarily ready to participate in these actions themselves due to unwillingness or lack of knowledge, they demonstrated interest in the issue of school closings, voicing their genuine opposition to the closings and acknowledging the protests they witnessed or saw in the newspaper as important work.

The emergence of justice-oriented responses indicates that engaging students in examining issues of social justice may provide opportunities to expand the purview of what students think a citizen has the power to do to shape his or her world. The case of Wendy, in particular, offers an example of the potential for engaging youth in learning about and acting on real and specific issues of injustice in their communities. In addition, looking across conceptions of citizenship at Hewitt and the LCLC reveals the possibilities of making citizenship more meaningful for students by drawing on their personal lives and communities. For the students at the LCLC, citizenship was enmeshed with their personal life goals, their strong ties to their communities, and their identification with humanity's struggles for freedom and equality. The implication of this finding is that youth's lives outside of school is essential to their development as citizens and can therefore serve as a rich resource for educating youth for citizenship.

## **CHAPTER 5: STUDENT CONCEPTIONS OF MATHEMATICS AND ITS ROLE IN CITIZENSHIP**

### **Introduction**

This chapter answers the second research question in my study: What are youth's conceptions about mathematics and their conceptions about the role of mathematics in citizenship? In order to be able to understand students' conceptions about the role of mathematics in citizenship, we must first understand how they perceive the role mathematics in the real world, which is part of their overarching conceptions of mathematics. A conception of mathematics as a collection of isolated facts and procedures as opposed to a means for reasoning about and understanding the world will likely yield different ideas about how mathematics plays a part in the real world and, more specifically, in the life of a citizen. Furthermore, students' conceptions are complicated by their conception of mathematics as a school subject, which may or may not be distinct from how they conceive of mathematics as an entity outside of schooling. How students understand the purpose of learning mathematics in school can lend insights into how students perceive the role of mathematics in citizenship.

Like in the previous chapter, I discuss the conceptions of mathematics of the students at the two research sites separately. For each of these sites, I categorized student conceptions of mathematics according to the hybrid conceptions of mathematics framework presented in Chapter 2. Broadly, students' conceptions were categorized as fragmented or cohesive (Crawford et al., 1994), with more elaboration about whether students demonstrated ideas about mathematics as modeling or as an abstract system (Petocz et al., 2007). Categorizing students' conceptions involved two components:

analyzing students' articulations of the definition of mathematics and analyzing students' descriptions of the role of mathematics in the real world. I then discuss students' perceptions about the distinction between the mathematics they learn in school and the mathematics in the real world in order to get at how students view the purpose of learning mathematics in school.

Finally, I provide an analysis of the connection between students' conceptions of mathematics and how they understand the role of mathematics in citizenship. First, I present students' direct articulations about how they perceive the relationship between mathematics and citizenship. Second, I discuss the implications of my findings about students' conceptions of mathematics and students' understandings of the purpose of learning mathematics in school in terms of what it means about the role of mathematics in youth's development as citizens. I conclude the chapter by looking across findings from the two settings to discuss broader implications about the connection between students' conceptions of mathematics and citizenship.

### **Student Conceptions of Mathematics at Hewitt**

While all of the students at Hewitt said that they believe mathematics is important in the real world, their ideas about the role that mathematics plays in the real world reflected their conceptions of mathematics. In addition, believing in the importance of mathematics in general did not mean that students saw their learning of mathematics in school in the same way. This section illustrates the mathematics conceptions of the students at Hewitt by analyzing 1) their own definitions of mathematics, 2) their examples of mathematics in the real world, and 3) their ideas about the purposes of learning mathematics in school and how it relates to their lives. Students' direct



articulations about the role of mathematics in citizenship are then discussed in relation to students' conceptions of mathematics.

### **Defining Mathematics**

In order to elicit their conceptions of mathematics, students were asked to define or describe what mathematics is to an alien from outer space that does not understand what humans call mathematics. Conjuring a space alien rather than a human was an attempt to remove any assumptions about shared understandings about mathematics. This section summarizes the ways in which students' statements defining mathematics reflected fragmented or cohesive conceptions of mathematics.

*Fragmented conceptions of mathematics.* Of the 21 students interviewed at Hewitt, 18 students were categorized as having fragmented conceptions of mathematics. Students with a fragmented conception of mathematics described mathematics as a collection of components. Almost half (10) of the students included a list in their definition of mathematics, which reflected the idea of mathematics as a collection. Most listed basic operations (i.e., addition, subtraction, multiplication, division), while others included specific concepts (i.e., exponents, variables), or branches of mathematics (i.e., algebra, geometry). Some students (4) were more direct in describing mathematics as being composed of various "operations" or "concepts," though the word "concepts" was not used to refer to cohesive elements of mathematics. For example, one of these students, Jorel, said mathematics is "different categories, concepts, how to do the concepts, all that," revealing a view that mathematical concepts are specific sets of procedures. Including Jorel, four students referred to the notion of mathematics as learning procedures or "steps." For these students, learning mathematics meant

expanding their collection of mathematics topics with which they are able to perform corresponding procedures.

A view of mathematics as procedural did not refer to just any kind of procedure but rather procedures that dealt with numbers and variables. In fact, almost half (10) of students named “numbers” as part of their definitions, referring to mathematics vaguely as including, having to do with, or dealing with numbers. Some students (5) also alluded to the form in which they encountered mathematics in school—as problems (including word problems) and equations to solve and for which to find answers. These descriptions of features of mathematics or mathematics learning in the classroom all come short of describing mathematics as a way of thinking or approach to understanding the world. Two students who were ultimately categorized as having fragmented conceptions of mathematics did not provide any definition. Devon simply called mathematics “a subject” and could not elaborate further, and Valerie skirted the question and simply stated that “math is something that you gonna have to do for your whole life.” Evidence of their conceptions as fragmented emerged as they explained how mathematics related to the real world (See the following section, “Mathematics and the Real World”).

*Cohesive conceptions of mathematics.* Cohesive conceptions of mathematics can take shape as ideas about mathematics as modeling, which defines mathematics as embedded in the real world and a means to understand it. Alternatively, it can take shape as ideas about mathematics as abstract, which defines mathematics as a logical system and way of thinking. Three of the 21 students at Hewitt were categorized as demonstrating varying degrees of cohesive conceptions of mathematics. These students’

definitions of mathematics stand apart from that of their classmates, so a more elaborate description of the students and their conceptions are provided.

One of the students demonstrating characteristics of a modeling conception was Reggie, who the teacher described as one of the top performers in her class. Mathematics was Reggie's favorite subject, and becoming a mathematics teacher was his backup plan to becoming a basketball player. When asked to define mathematics, Reggie stated, "It's hard, 'cause math is basically everything," then went on to explain his view that "math can relate to any subject":

'Cause science, it has to do with inches and all that. Social studies, you could do it with the... the economy, such as money and banks. And in literature, you can still relate... well, it's not as much similar, but you still can relate to stuff in literature, such as like dates and time periods.

Reggie's explanation shows that he viewed mathematics as being related to numbers and specific concepts (i.e., measurement), like his peers. However, the fact that he defined mathematics by its relationship to other school subjects shows that he did not see mathematics as being confined to procedures and discrete topics to master. Instead, he defined mathematics as interdisciplinary; for him, the essence of mathematics was its role in understanding what is outside of the mathematics classroom.

Jesse was the second student who exhibited characteristics of a cohesive conception of mathematics. More specifically, the way he talked about mathematics showed evidence of an abstract conception of mathematics. According to the teacher, Reggie was only second in academic performance in her classroom to Jesse. Mathematics was Jesse's favorite subject, and he was confident in his knowledge of mathematics; about whether he believed himself to be good at mathematics, he said, "The

word believe is so small. Use the word know; I would use the word know. I know math.” Jesse defined mathematics as “answering questions with numbers, sometimes pictures of graphs, tables, and letters.” The list in his definition consists of different representations used typically in mathematics as part of an approach rather than discrete topics to master. In addition, Jesse appreciated mathematics for its own sake and asked questions about mathematics beyond the classroom or even beyond real world scenarios: “Sometimes I ask the students in my class what is the square root of  $\pi$ , and I know what it is . . . I’m trying to memorize the cube root, but I think if I memorize that I’ll forget the square root.” Although his inquiry is about calculating and memorizing a number rather than achieving conceptual understanding, it shows that Jesse had a sense of mathematics as a discipline with its own questions within that discipline rather than just a set of procedures.

The third student whose definition showed signs of moving towards a cohesive conception of mathematics was Rashida. An aspiring writer, Rashida stated, “I would define math as a type of writing using numbers and problems to express itself,” and added, “Numbers show how you solve problems.” Like Jesse, Rashida also exhibited abstract notions of mathematics as she described it as an approach that utilizes numbers to “express” something rather than as procedures or topics involving numbers. However, Rashida’s definition was inconsistent. In her final interview, she described mathematics as “a curricular subject” where you “solve an equation or problem that’s thrown upon you.” Unlike Jesse, Rashida struggled in mathematics class, though she was a diligent student who strived to excel in school. Perhaps it was her struggle with school mathematics that resulted in a portrayal of mathematics in school, specifically, as

something forced on her unwillingly even though she had given a rather poetic definition of mathematics in her initial interview.

Reggie, Jesse, and Rashida showed signs of moving towards cohesive conceptions of mathematics in different ways and to different degrees. None of them articulated a fully developed cohesive conception of mathematics. Reggie's examples of mathematics found in other subjects relates mathematics to other disciplines but does not necessarily reflect a view of mathematics as a way of understanding these disciplines, and Rashida's definition of mathematics is not consistent. Even Jesse's statement about "answering questions" and his personal story about memorizing the cube root of  $\pi$  could be pointing to an appreciation for finding correct answers rather than solving complex problems. Despite these holes, their responses are starkly different from those of their classmates. The extent to which these students' conceptions of mathematics are cohesive are further explored in the following sections, which describe students' conceptions of the relationship between mathematics and the real world as well as their ideas about the purpose of learning mathematics in school.

### **Mathematics and the Real World**

All of the students at Hewitt said they believe that mathematics is important and supported this idea by talking about mathematical applications in the real world. Such a response reveals that for these students, the primary reason they considered mathematics to be important has to do with its necessity in the real world. The students' examples of its relevance in the real world were similar across both those classified as having fragmented conceptions of mathematics and those moving towards cohesive conceptions, though there were some nuances. All students gave examples of specific applications of

mathematics helping them to count, enumerate, or perform basic operations to find numerical answers in situations in their lives. These examples fell into four main types of contexts: 1) money-related contexts, 2) careers, 3) everyday tasks, and 4) academic subjects. This section describes and analyzes the various types of examples that students offered to explain the role of mathematics in the real world, including their own lives, across all students. The section concludes with describing the nuances between the responses of students classified as having fragmented conceptions of mathematics from those moving towards cohesive ones.

Although money-related contexts could be classified under either everyday tasks or careers, it is treated separately because of its dominating presence in students' responses. For the students at Hewitt, the applicability of mathematics to money-related situations was the most obvious and strongest example of the role that mathematics plays in the real world. All 21 students mentioned at least one money-related example or alluded to a general connection between mathematics and money. Seven students gave solely examples related to money, and some were explicit about this limit. For example, when Leandra was asked about whether she used mathematics outside of school, she replied, "Probably I would say the store. That's it." A few students (3) made general statements about the relationship between mathematics and money and talked about needing mathematics to count or "deal with money." The rest of the students gave specific examples of how mathematics was useful in money-related scenarios. Most commonly, students talked about counting money (11) or needing mathematics at a store to calculate cost, change, or discounts (16). Students also mentioned specific tasks in managing one's personal finances, such as calculating the pay one is owed (2) or how

much one owes in bills or taxes (3). Three students named money-related jobs requiring mathematics, including working at a financial company or bank. Another observation was that there was an emphasis on the role of mathematics in verifying quantities to prevent being cheated. Eight students specifically mentioned that mathematics is useful against being cheated out of their money, and an additional 5 students did not mention being cheated directly but talked about using mathematics to verify that their change or paycheck was correct.

Seven students also gave examples of mathematical applications for future jobs or professions including the three who named money-related careers. Other examples of occupations included being a mechanic or technician, which require basic calculations or measurements, such as knowing how long to drill something or how much antifreeze to pour. Darius said that “if you wanna be somebody else like big, like a doctor” also requires knowledge of algebra. When asked to explain this statement, he said that they need “certain tools and stuff” so as “not to kill a person if they’re doing surgery.” Two of the students did not mention specific professions but made vague statements about needing to know mathematics for one’s work in the future. Students thus seemed to have a sense of the applicability of mathematics in professional settings, but their ideas were vague or based on speculations or assumptions.

Twelve students mentioned other tasks in their current lives that do not involve money. Some were everyday practical tasks like telling and measuring time, reading street numbers, and cooking. One student talked about using mathematics to help his father on his construction projects by measuring spaces for painting or putting down floor tiles. Five students mentioned using mathematics when playing games, most commonly

basketball. The theme of mathematics for verification emerged when Shawn said he relies on mathematics to add up his team score and “make sure we not getting cheated.” Ferrell said, “When I’m playing a [basketball] game, I use angles.” Shanelle said mathematics could be employed to divide people into groups for games in general. There was also one example that seemed contrived:

You would... if you’re a person that... I don’t know what that disease is called but you don’t remember how old you are or anything, all you know is the year you was born, and you take today’s date, and you know today’s date, you’ll find out how old you are by doing that.

This unlikely scenario that Qadira fabricated to back up her claim that mathematics is important reflects a desire to defend her belief that mathematics is important despite her inability to provide examples beyond ones involving monetary calculations. Finally, three students mentioned that mathematics relates to other academic subjects. One of them was Reggie, whose response was previously described in the section about students’ definitions of mathematics. The other two students were Valerie and Emmett, who both connected mathematics to science; Valerie talked about having to perform basic calculations for science assignments, and Emmett made a vague reference to the connection between the two subjects.

The differences in the examples that students with cohesive conceptions of mathematics gave were slight. In fact, Rashida’s responses were no different from those with fragmented conceptions of mathematics. Her examples consisted of using mathematics for making calculations involving money (taxes, income, spending, including not getting “ripped off”) and measuring time. Reggie differed from his classmates because, as mentioned in a previous section, his examples connecting



mathematics to other subjects were not limited to science. Also, his money-related examples were different from those of his classmates. While two other students mentioned working at a bank as a teller, Reggie's example of a career involving money was a "bank stocker"; he probably meant a stockbroker, but his mention of banking as dealing with stocks is more sophisticated than banking as dealing in simple transactions. Finally, Reggie's previously mentioned association of mathematics with social studies was that social studies deals with the economy, which refers to an application of mathematics on a larger, systemic level rather than a personal, transactional one.

Jesse also differed from his peers in how he discussed money in that he did not frame money as a prominent example of mathematics in his life. Initially, when asked to define mathematics, he misunderstood the question to mean how he might explain mathematics to someone else and said, "Like to a person who doesn't like math, I would say think about your money. Then to other people, I would say think about everyday life situations where you use math." In this statement, Jesse implied that thinking about mathematics in terms of money is the most basic way to relate to it; it was as if he recognized that relating mathematics to money was only a first step towards understanding the role of mathematics, a step he saw himself as being well beyond. In terms of his other examples, however, his answers were similar to those of his peers. His explanation for why mathematics is important was that "people would not know how to convert stuff," such as when cooking, and he said he uses mathematics when playing first person shooter video games because he needs to know how many bullets he has.

Across students with fragmented and cohesive conceptions of mathematics, students primarily saw the relevance of mathematics in cases where they needed to

enumerate, count, or calculate something in their lives. For the students at Hewitt, learning mathematics was most saliently a means to navigate real-world circumstances dealing with numbers and to ensure that others do not take advantage of them. Reggie and Jesse indicated a higher level of sophistication and awareness of how mathematics can be applied, and Reggie came closest to the idea of mathematics being involved in the workings of systems like the economy, though he may have been imagining simple applications of mathematics rather than its role in modeling the workings of such a system. Other students who attempted to give examples of more complex applications of mathematics gave vague or forced explanations, perhaps reflecting their beliefs about the importance of learning mathematics beyond simple applications for their lives.

### **School Mathematics and the Real World**

In this section, students' beliefs about the purpose of learning school mathematics are explored. The students at Hewitt were split when it came to their beliefs about learning mathematics in school. Almost half (9) of the students believed in what will be referred to as a duality in mathematics—that is, the idea that there are two types of mathematics: the mathematics that is useful and applicable in the real world and the mathematics one learns in school but is not applicable. The rest (12) of the students believed that all of the mathematics they learned in school is somehow relevant to the real world. This section explores how the students in these groups made sense of the purpose of learning mathematics in school given their beliefs about its duality. A summary of students' conceptions of the role of school mathematics is found in Table 8.

Table 8

## The Role of School Mathematics Beyond Basic Applications, Hewitt

Role of school mathematics	Fragmented Conceptions	Cohesive Conceptions
<u>Mathematics as dual</u>		
Academic advancement, only	6	-
Knowledge, only	1	1
Depends on career	1	-
<u>Mathematics as non-dual</u>		
Certain future application	5	-
Just in case	1	1
Thinking skills	-	1
General	4	-

*Dual views of mathematics.* There were 9 students who were categorized as having a dual view of mathematics, which included Rashida, who showed signs of an abstract (cohesive) conception of mathematics. When asked about whether they believed that the mathematics they learned in school was the same as the mathematics in the real world, these students differentiated between school mathematics that was relevant to the real world and that which was not. Most students named specific concepts or mathematical tools or representations that they believed were not applicable to the real world, most commonly algebra (4 students), but also square roots, fractions, slope, graphing, and order of operations. A couple of students claimed that the only mathematics that was useful in the real world was basic operations including addition, subtraction, multiplication, and division. Devon did not name specific topics but made the general statement, “Like some math, you’re not gonna use like when you’re older.” Given these views, students had three types of explanations for learning mathematics beyond what they saw as being useful in the real world: 1) academic advancement, 2) attainment of knowledge, and 3) use in specific careers.

Most (6) of the students who viewed mathematics as dual believed that the sole purpose of learning school mathematics beyond basic, applicable operations was for academic advancement. Three of these students expressed skepticism about the purpose of learning mathematics in school. Jorel said he wondered about why algebra was taught in school, while Reanna and Cienna both said they believed that there was no point in learning what they believed were impractical topics in mathematics. Cienna was most firm in vocalizing her belief that “we learn [mathematics] for nothing” and that “it’s a waste of time.” When asked why they believed mathematics was taught in schools, these students explained that learning mathematics would allow them to advance to high school and college by preparing them to learn the more difficult mathematics they would encounter in these future educational settings. In addition to helping them advance academically, Reanna and Cienna believed that mathematics would help open up “opportunities in life” (Reanna) and help them to “get a decent job” (Cienna).

Two students who held dual views of mathematics said that it is important to learn school mathematics for the sake of knowledge. One of these students, Shanelle, said, “Just because we don’t use it don’t mean we don’t have to know it,” and added that the reason to learn mathematics was “to boost our knowledge.” The other student was Rashida, whose inkling of a cohesive conception of mathematics was reflected in her statement that learning mathematics was part of “embrac[ing] the world and knowledge.” Like her definition of mathematics as a form of human expression, Rashida’s explanation of the value of knowledge drew on a sense that mathematics is more than a collection of facts and procedures to apply, though she was vague about the way in which mathematics transcended fragmented conceptions. Rashida trusted the value of knowledge produced

and passed down by humankind, even while admitting that she herself did not yet see its significance:

Even if we don't see the importance, our ancestors and them back thought it was like a great thing and they were so amazed to discover it . . . I just know somewhere that they're teaching us this for a reason, they're not just wasting our time, they're thinking of something, I just don't get it yet.

In addition, for Rashida, attaining this knowledge was part of an individual's intellectual development, or "to be smart."

The final student who saw mathematics as dual, Qadira, separated the mathematics that all students would need to learn from the mathematics that some might need depending on their career aspirations. Qadira stated that not all mathematics is useful, such as learning how to calculate square roots of numbers. However, she admitted that "it all depends on what we wanna be," and named being an accountant as someone who would need to know how to calculate square roots. Despite this seeming contradiction, she was firm in her stance that learning mathematics beyond basic operations was unnecessary in terms of its relevance in the real world: "So it help you with certain things, but we really don't need it." For Qadira, the possibility of needing to know more advanced topics in mathematics for one's future career was not enough reason to warrant learning it in school. Instead, Qadira believed that the primary reason to learn mathematics in school was for knowledge and academic advancement. Like Shanelle and Rashida, she said, "We just need [mathematics] as knowledge in our head," and like many of her other peers explained that learning mathematics is important preparation for high school and college.

*Non-dual views of mathematics.* The remaining twelve students at Hewitt believed that all the mathematics they learned in school is relevant in the real world outside of school. Some students made general declarations of this belief without further explanations behind it, but most pointed to uncharted futures and experiences as the reasons for learning mathematics that might not yet have revealed their uses. Two of the students with non-dual views of mathematics were Reggie and Jesse, whose ideas about the relationship between school mathematics and the real world reflected the unique features of their conceptions of mathematics.

The most common reasoning that students articulated was that the use for mathematics would become evident at some future point in students' lives. Five of these students were certain of such future scenarios. One of these students, Malia, stated, "You'll use it at work." Unlike Qadira (with a dual conception of mathematics), who made it a point to say that only certain careers require knowledge of mathematics, Malia did not make such a distinction. The other four students—Calvin, Darius, Shawn, and Yasir—made more general statements claiming the certainty of needing mathematics in the real world. Calvin, for example, said, "Because one moment of your life it's gonna come, and you better have the skill to know it," later adding, "Everything they teach you, you're gonna need it to use for the outside world, out in the real world."

Two students also believed learning mathematics is important for the future, but for them this future was not certain. Instead, both of these students said that learning mathematics was important to be prepared "just in case" for what one may encounter. One of these students, Ferrell, referred generally to "a scenario where you have to use it." The other student, Reggie, referred more specifically to "in case you need to know

something or you're trying to be something in life.” The latter part of the statement is similar to Qadira’s response in that Reggie was recognizing that only certain careers would qualify as employing mathematics, but it was different in that he chose to embrace the uncertainty and accept that learning mathematics for possible though uncertain future prospects was valuable. Reggie’s response is fitting with his conception of mathematics as being multidisciplinary and his awareness of the possible applicability of more advanced mathematical topics.

Unlike the students who pointed to the future to make sense of their conceptions of mathematics as non-dual, the remaining five students did not say that some of the school mathematics they had learned had not yet proved useful in their lives. Two of these students, Leandra and Valerie, simply claimed that all of the mathematics they learned in school is needed in their lives outside of school without qualifications, but both of these students’ responses to whether all mathematics learned in school is needed in life outside of school were coupled with uncertainty. Leandra’s doubt showed in her intonation—“Mmmmm... yeah?”—while Valerie’s in her choice of words: “It should be.”

In contrast, Andre was overconfident, even providing an explanation that was forced. Andre explained that even algebra was applicable in the real world, giving the example that he uses algebra “when I’m making a cake or a pie,” though he was unable to explain how algebra was involved in those tasks. Alisha also exhibited confidence. Alisha stated that the mathematics learned in school is tied to the real world, but her explanation backing up her claim only included examples of mathematics as equivalent to the presence of numbers or simple operations in the world. Alisha opened up her school notebook, flipping to the reference tables in the back cover, and argued, “Math is

everywhere around you; math is in this composition book.” Her second example was a reiteration of needing to know the “basic steps in math” to perform monetary calculations. For all four of these students, making a direct connection between the mathematics they learned in school and the mathematics in life outside of school was either a difficult or a forced task.

The fifth student who did not point to future scenarios to explain the applicability of mathematics was Jesse. Jesse’s explanation for his belief in the relevance of school mathematics was unique and also reflected the greater complexity of his conception of mathematics. Jesse claimed that he uses everything he learned in school in his life, but he did not confine the word “use” to direct application of mathematical procedures. Instead, he explained that learning mathematics enabled him to learn not just how to work with quantities but also to “answer challenging questions” and to develop “critical thinking.” When pushed to explain what he meant by critical thinking, Jesse said, “Like if they would give you like a challenging question that you would have to do all this stuff for, you gonna have to memorize this stuff to go onto the next things.” In other words, Jesse saw critical thinking as something that requires knowledge, including memorized knowledge, to be employed in solving problems requiring multiple steps. It is unclear whether by “go onto the next things” Jesse was referring to learning more advanced mathematics or whether he was talking about moving on in a problem-solving process. Either way, Jesse’s emphasis was on the process of thinking and the ability to solve complex problems rather than on the direct applicability of mathematical topics and concepts learned in a mathematics class.



Just because students did not separate school mathematics from mathematics in the real world did not necessarily mean they believed that the primary function of learning mathematics in school was for the real world. Some of the students with non-dual views of mathematics also upheld the attainment of knowledge as a reason to learn mathematics in school. Leandra, who was uncertain in her response about the connection between school mathematics and the real world, was more confident in the reason that students must learn mathematics “[s]o you could be smart,” which she explained as meaning that “you gotta know something.” Alisha, who was working towards a positive personal relationship with mathematics, also said that mathematics is important to learn simply because she believed it to be important: “It’s one of the major subjects. You have to know math. If you didn’t know math, how would you grow up knowing what 4 times 4 is, 8 times 8, 36 times 36? You would never know if you never learned math in school.” Other students—Calvin, Malia, and Valerie—also acknowledged the role of mathematics in academic advancement.

*Summary.* As summarized in Table 8, the students at Hewitt were split in terms of whether they saw mathematics as dual, or different between in school and in the real world outside of school. Most of the students who characterized mathematics as dual said that learning school mathematics was for academic advancement or for the sake of attaining more knowledge. On the other hand, most of the students who characterized mathematics as non-dual stated that future applications for mathematics were at least possible. Because these futures were uncertain, the references were general or vague. There were also students who stated a non-dual view but either expressed uncertainty or gave forced examples to back up their beliefs.

This shows that for many students, their beliefs about the relationship between mathematics and the real world were not the same as their beliefs about the relationship between school mathematics and the real world. In addition, for the students who had a non-dual view, their beliefs were unsupported by any concrete, realistic examples that might anchor these beliefs. It is not surprising, then, that students primarily named tasks related to counting, enumeration, and basic operations as their evidence for believing that mathematics is important. However, only a few students articulated any skepticism about learning mathematics that they did not see as relevant. The rest of the students accepted a different role of mathematics in their lives—that is, its role in academic advancement, attainment of knowledge, and possible necessity in a future career or other situation. Only one student, Jesse, articulated a broader role for school mathematics as preparation for solving complex problems, though he may have been referring to academic mathematical problems.

### **Mathematics and Citizenship**

With an understanding of how students view mathematics, its relationship with the world, and the purpose of learning mathematics in school, we begin to see how students understand the relationship between mathematics and citizenship. In this section, I approach students' conceptions of this relationship in two ways. First, I present how students articulated their views about how mathematics relates to citizenship, relating their perceptions to their conceptions of mathematics and their conceptions of citizenship. Second, I draw on the analysis of students' conceptions of mathematics, including their views about school mathematics, to draw out implications about how students understand the role of mathematics in relation to citizenship.

*Student perceptions of the role of mathematics in citizenship.* Students were asked to articulate their ideas about the connection between mathematics and citizenship. More than half of the student participants at Hewitt (11) said they saw no connection between mathematics and citizenship. Recall that almost all of the students at Hewitt held a personally responsible conception of citizenship, which focuses on good character and good deeds. Because fragmented conceptions of mathematics focus primarily on performing calculations to in-school problems and practical aspects of daily life, most of the students had trouble making a connection between mathematics and citizenship. One of the students, Andre, specified that social studies is the school subject through which one learns about citizenship, not mathematics. In social studies, he explained, students learn about sacrifices people made in history, such as Harriet Tubman and Anne Frank, which teaches people in the present to be grateful. In other words, learning stories about real people could influence students to be better citizens by inspiring them to have certain attitudes that align with their personally responsible conceptions of citizenship, which was not something students gained from their mathematics learning.

There were 10 students who said that mathematics could support citizenship. Five of these students did think of the mathematics classroom as providing opportunities to develop positive traits and behaviors, which they attributed to their teacher, Ms. Fuller. The students explained that Ms. Fuller would often guide students to make good decision. For these students, it was their teacher, who happened to be a mathematics teacher, who provided the link between mathematics and citizenship development, not mathematics itself. The other five students made a direct link between mathematics and citizenship, including Jesse, Rashida, and Reggie, the three students who exhibited evidence of

cohesive conceptions of mathematics. Their particular conceptions of mathematics played into how they perceived the role of mathematics in citizenship.

Two students forced a connection between mathematics and the idea of citizenship as good deeds by proposing to quantify goodness. Yasir used the mathematical terminology of positives and negatives to describe helping or hurting the community; he said that people could learn “the difference between destroying the community and helping the community . . . because a positive can help you gain stuff, and a negative can help you lose stuff.” Jesse was the other student who quantified goodness; he said, “I would count all the good things I do . . . so people could see the good things I did.” In his case, his abstract conceptions of mathematics did not seem to translate into his understanding of the role of mathematics in citizenship. Instead, his answer (along with Yasir’s) is reminiscent of Alisha’s forced connection between mathematics and the real world by pointing to the reference tables in her composition book. In both cases, a desire to see a connection, along with perhaps feeling pressured to give an affirmative answer to a teacher figure, resulted in a superficial example.

Rashida tied mathematics to citizenship as improving the community, but she was unable to explain the connection:

Like... I can't think. I know it does, but I can't imagine how. I don't know . . . I just think that along with learning the basics, along with learning, the basics can help... even if the basics don't have anything to do with it, they can help enrich the world around us, including making our community better.

Rashida’s response is consistent with her ideas about school mathematics in that she expresses a sense of trust that mathematics (which she refers to as “the basics” here) is significant in the world somehow, but she sees herself as unable to quite grasp it.

Rashida seems to either have an inkling that she cannot yet explain or a strong desire to believe that is manifesting in the way she talks about mathematics.

Finally, Shawn and Reggie gave examples of how mathematics can be used in the process of helping with performing a good deed or obligation, but their differing conceptions of mathematics were reflected in their answers. Shawn gave several examples of quantifying actions towards improving the community: “Uh... like if we pick up a certain amount of trash each day, our community would be cleaner. Or if we try to influence a certain amount of people each day, we could start to... we could start to like get a better community and influence people.” In these examples, Shawn was applying numbers to the situation, which is in line with a fragmented conception of mathematics. On the other hand, Reggie’s example involved using mathematics to plan and build something positive for the community: “Like say if I be a... what is it called... not a construction worker but... like a building planner, for a good citizen I could help like make orphanages, like... doing stuff like that.” Linking mathematics to planning a building, not just constructing it, reflects a view of mathematics as being part of more complex processes than simply counting or performing operations to arrive at numerical solutions. In this case, Reggie’s conception of mathematics as modeling is strongly visible.

Students’ conceptions of mathematics were linked to how students saw the relationship between mathematics and citizenship. Fragmented conceptions of mathematics made it difficult for most of the students at Hewitt to make connections between mathematics and citizenship, and even the connections that they did make were indirect or superficial. Some students referred to mathematics as a school subject, which

led some students to see it as disconnected from citizenship because it did not deal with the real world unlike subjects like social studies, while it led other students to link it to citizenship because the teacher infused lessons about personal responsibility into the classroom in addition to mathematics lessons. Other students, including all three who demonstrated evidence of cohesive conceptions of mathematics, claimed a direct connection between mathematics and citizenship, but even most of these were forced or simplistic. Only Reggie, with a comparatively sophisticated conception of mathematics as having a broad and integral role in the real world, was able to provide an example that portrayed mathematics as an asset to create something complex.

*The hidden role of mathematics in citizenship.* Although most of the students denied a connection between mathematics and citizenship, their conceptions of the role of mathematics in the real world and their views about the purpose of learning mathematics reveal that mathematics does play a role in their development as citizens, in particular as personally responsible citizens. Regardless of their conception of mathematics, students' supporting examples for why mathematics is important predominantly included examples related to handling money, applicability in one's career, everyday tasks, and relation to other academic subjects. All of these examples are related to an individual performing the tasks of a responsible citizen, consumer, and as a capable pupil in school. For the students at Hewitt, being critical with mathematics was limited to employing their knowledge of arithmetic operations to make sure that they were not cheated out of their money or points in sporting events. It was only when students were asked directly about the relationship between mathematics and citizenship that a few students mentioned how mathematics could relate to deeds that affect more than the individual.

Students' views about the purposes of learning mathematics in school also reveal how students saw the role of mathematics in their development as citizens, or members of society. Students saw mathematics as important to learn regardless of whether they saw it as relevant in the real world because of the gate-keeping role that mathematics plays. Students saw learning mathematics as a means towards attaining a certain level of education and a standard body of knowledge that would also help one attain gainful employment. In other words, the message they were receiving by learning mathematics in school was about personal responsibility, about attaining the knowledge and credentials valued by society. Even for the students who had non-dual views of mathematics, their acceptance of learning mathematics despite their inability to articulate how the mathematics they were learning in school related to the real world shows that these students were learning to trust in established systems rather than to think critically about these systems. Thus the role that mathematics was playing in the development of the students as citizens was equipping them with the skills, credentials, and attitude to live as personally responsible citizens.

### **Student Conceptions of Mathematics at the LCLC**

The following sections offer an analysis of the conceptions of mathematics and the relationship between mathematics and citizenship for the students at the LCLC. Like at Hewitt, all students expressed that mathematics is important and necessary in the real world, and a majority (13 of 17) of the students exhibited a fragmented conception of mathematics. Four demonstrated various signs of having or moving towards cohesive conceptions. However, the LCLC students' broader life experiences outside of the classroom informed their ideas about the relationship between mathematics and the real

world. Their particular perspectives were also evident in how they talked about the relationship between school mathematics and the mathematics in the real world, and ultimately, how they saw the relationship between mathematics and citizenship.

### **Defining Mathematics**

*Fragmented conceptions of mathematics.* Of the 13 students at the LCLC who were categorized as having fragmented conceptions of mathematics, eight revealed this orientation in their definitions of mathematics. Students categorized as having a fragmented conception of mathematics described mathematics as enumeration and as a collection of operations, procedures, facts, or ideas related to numbers that could be applied to situations in order to obtain an answer. Four of the students—Hector, Lara, Lisa, and Nila—defined mathematics by listing numerical operations or topics related to numbers. For example, Nila listed basic operations like addition, subtraction, and multiplication, as well as concepts like angles and sizes. Another four students—Bianca, Edwin, Raul, and Shaquan—described mathematics as arriving at solutions through numerical manipulation or application of mathematical procedures. For example, Raul defined mathematics as “a bunch of equations and a bunch of problems and you have to solve what those things are.”

Other students’ definitions of mathematics were difficult to categorize, though these students were ultimately categorized as having fragmented conceptions based on their descriptions of mathematics in the real world. Xavier called mathematics an “exercise for your brain.” It is unclear from this statement alone whether he was referring to mathematics as thinking or simply referring to practicing procedures. Another student, Evelin, did not provide a direct definition but only alluded to its



necessity in the real world. Finally, another three students—Felipe, Lance, and Marcos—expressed difficulty in articulating a definition and ultimately did not provide one.

*Cohesive conceptions of mathematics.* Four students were categorized as demonstrating characteristics of cohesive conceptions of mathematics: Isaiah, Wendy, Wesley, and Zohelia. All of these students except for Wendy expressed enthusiastic love for mathematics, calling it their best or favorite subject, and saw themselves as successful in school mathematics. These four students' definitions of mathematics showed evidence of cohesive conceptions of mathematics to varying degrees and in different ways.

Isaiah and Zohelia made similar remarks as Evelin about the necessity of mathematics in the real world without actually providing a definition. However, other statements they made showed characteristics of a modeling conception of mathematics. Both of these students described mathematics as embedded in the real world. While the rhetoric that “mathematics is everywhere” was common, even among students with fragmented conceptions, it was often said to mean that if one looked hard enough, a mathematical application could be found for most or all contexts. On the other hand, Isaiah and Zohelia expressed a different rhetoric—that everything needs mathematics. The latter rhetoric implies that mathematics is a part of everything rather than externally applied. Isaiah, for example, stated, “I believe our whole world revolves around math,” and Zohelia said, “If you don't know nothing about math, you don't know nothing about the world, that's how I feel.”

Wesley defined mathematics as “a series of puzzles,” which alludes to ideas about logic and problem solving and therefore lines up with a view of mathematics as abstract. However, as Wesley further described his view of the role of mathematics in the real

world, he also revealed a view of the role of mathematics as modeling. Wesley comes closest, then, to exhibiting a conception of mathematics that combines elements of both types of cohesive conceptions. More details about Wesley's modeling perspective will be discussed in the following section, which elaborates on students' conceptions about mathematics and the real world.

Finally, Wendy articulated a definition of mathematics that hinted at moving towards a cohesive conception of mathematics as modeling. Wendy defined mathematics as a tool to be used in the real world; "It has to do with numbers. The real world. Like, it's problem solving. You have a problem, I bet you have math to deal with it. So. Mostly problem solving. It's something, it's a tool to help you to find an answer kind of thing." Her statement leaves questions about whether she saw mathematics as a tool to be applied to find discrete answers or as a tool for modeling, a means for understanding complex problems. However, her emphasis on the real world reflects a conception of mathematics in which the relationship between mathematics and the real world is central. Like with Wesley, more details about Wendy's conceptions of mathematics will be explored in the following section.

### **Mathematics and the Real World**

As with the students at Hewitt, the students at the LCLC also supported the idea that mathematics is important by naming applications for mathematics in the real world. The types of responses students gave were also similar. At the LCLC, like at Hewitt, students' responses could be categorized as relating to money, careers, everyday tasks, and academic subjects. As in the section about the students at Hewitt, this section outlines the various examples of applications that students described. However, the

responses of students with cohesive conceptions of mathematics in this case were different enough to be separated from the responses of the students with fragmented conceptions, so each of these groups is analyzed separately.

*Fragmented conceptions: Mathematics as applications.* Students with fragmented conceptions of mathematics tended to name the applicability of specific mathematics topics to find discrete numerical answers or solutions for real-world situations. Such an approach resulted in a limited view of the relationship between mathematics and the real world; mathematics was most often described as being useful for daily, practical matters, including dealing with money, applying it in certain jobs or careers, and performing other simple tasks involving numbers.

All students with fragmented conceptions named money-related applications for mathematics. Most commonly (8 students), they elaborated that mathematics was used for handling one's personal finances, such as counting one's money, paying bills, and paying taxes. Students also commonly talked about mathematics being useful for clothing and grocery shopping, including figuring out deals and discounts (5 students). Several students mentioned careers in which money is involved (i.e., cashier, accountant, tax clerk). Unlike at Hewitt, only one of these students (Shaquan) alluded to using mathematics as a defense against being robbed.

Eleven of the 13 students mentioned future jobs or careers, with most (8) stating the caveat that the applicability of mathematical skills or topics depends on the job. For example, Lisa explained that someone in construction would need geometry; an accountant would need to know figures, conversions, fractions, and decimals; a store clerk would only needs to know how to count, multiply, and divide; while a

mathematician would need to know “all that stuff.” Lisa’s elaboration is representative of the typical responses students gave about the types of careers involving mathematics and the type of mathematics involved. Two other students did not state that it depends on the job, but they listed specific jobs in which mathematics would be useful, and a third student simply said that mathematics was important to learn for future careers. Other examples students mentioned include knowing statistics for business, fractions for culinary careers, using the correct-numbered clipper when cutting hair, and being able to “put the right dope on the scope” (making the correct rifle scope adjustments depending on target range and environmental factors) as a sniper in the army.

Aside from money and career-related tasks, six students mentioned other life tasks where mathematics is applicable. These tasks were limited to uses of mathematics for measurement, enumeration, and counting. Three students described using fractions and measuring instruments for cooking, and two mentioned reading the time or temperature. One student, Raul, gave a longer list of examples, which included keeping track of the number of miles a person runs, the number of light bulbs used, knowing one’s shoe size, and filling a ball with the correct psi.

Raul and one other student, Shaquan, also mentioned using mathematics when playing games. Both students’ examples involved using mathematics to manage the game’s play currency; Raul’s example was making weapon purchases using bottle caps in a role-playing video game, while Shaquan’s was managing play money in the board game Monopoly.

Across all the examples that students gave—whether related to money, jobs, or other life tasks—the common thread is that mathematics was treated as fragmented. In

most cases, mathematics was positioned as a means towards finding a discrete numerical answer. In the examples involving money, for example, mathematics was reduced to a tool used solely for calculating discrete amounts—how much money one has, how much one owes, how much something costs, etc. When students gave examples of careers or life tasks requiring mathematics, the tendency was to match specific mathematical topics or procedures to perform specific number-based tasks. The applicability of more abstract mathematical topics was not apparent to students, so the list of topics that they mentioned was limited to basic concepts and operations, including enumeration, counting, measurement, and arithmetic, though some also included statistics.

*Cohesive conceptions: Mathematics as embedded in the real world.* Isaiah, Wendy, Wesley, and Zohelia hinted at the role of mathematics as being integral to the real world rather than applicable to specific applications. Whether talking about money, careers, or daily tasks, these four students went beyond the typical responses that characterized the responses of the students with fragmented conceptions.

Three of the four students with cohesive conceptions of mathematics (all except Isaiah) acknowledged the important role mathematics played in dealing with money. When talking about their own uses of mathematics, these students named typical applications involving money, including counting money, paying bills, and calculating discounts. However, they also proposed atypical applications; Wesley talked about the importance of mathematics in understanding different currencies across countries, and Wendy said mathematics is necessary to understand the city's debt, which she thought was being handled poorly. These examples extend beyond simple personal transactions to thinking about mathematics being involved in systems involving money.

Zohelia only gave typical money-related examples, but she showed evidence of moving towards a cohesive conception in her description of careers. Unlike students with fragmented conceptions of mathematics, most of whom stated that only certain careers require knowledge of mathematics, Zohelia was the only one who said it was useful in “everything that you choose to be.” She named teachers, doctors, and nurses in her list of jobs requiring mathematics, which stray from the typical examples with more obvious, direct applications of mathematics (i.e., cashier, accountant, construction worker) mentioned by her peers with fragmented conceptions.

Wesley’s only example of work involving mathematics was construction; unlike his peers, however, Wesley described using mathematics in terms of figuring out a complex problem rather than presenting it as needing to know a list of topics that are applicable for specific tasks. Wesley described the role of mathematics in construction in the following way:

Um, also with my dad, we renovate houses, like that’s his thing but sometimes he’ll ask me to come along so we’ll do the kitchen, and we need to use math, like the angles, the side, and if we put the stove here, and this here, how much room do we have here.

Contrast this response to that of Marcos, who like many of his peers with fragmented conceptions of mathematics, described the role of mathematics by listing topics needed to apply to specific tasks in construction: “I’m trying to build houses and stuff, so I need to learn measurements, angles, everything.” Wesley’s description positions mathematics as embedded in the complexity of the real-world situation rather than applied externally to it.

In addition to money and job-related examples, the four students listed applications of mathematics in everyday life much like their peers with fragmented conceptions of mathematics. However, the examples that they gave were less typical, going outside of common contexts involving cooking, time, and temperature. Isaiah said he uses mathematics when he fills his baby's milk bottle, Wendy talked about finding numbered seats and figuring out the correct wattage of bulbs she needs, and Wesley said mathematics is involved in drawing, singing, and dancing. Among students with fragmented conceptions, Raul had been the only one that gave more than the common examples given by the rest of his peers. Although these examples are not in themselves indicative of cohesive conceptions, by providing atypical examples, the students tried to argue that mathematics plays a role in the real world beyond obvious applications. Wendy conveyed this point when she described a moment of realization that mathematics was present in an unexpected setting:

It sounds cliché when you say math has to do with everything, which it really does. A couple times I caught myself trying to find a numbered seat or something. I'm like, wow, that has to do with math, and it's true.

Finally, Isaiah also said he uses mathematics when playing card games and chess. Unlike Raul and Shaquan, whose game examples were limited to using mathematics to handle currency, Isaiah alluded to mathematics playing a role in figuring out strategies.

Isaiah, Wesley, and Zohelia also saw mathematics as interconnected with other school subjects. Zohelia and Wesley stated firmly the idea that all subjects involve mathematics, explicitly naming social studies and even reading as being included in the list along with science, a subject often featuring equations and calculations and therefore more typically associated with mathematics. Isaiah named specific interdisciplinary

examples, like studying about space and about populations. In contrast, Felipe was the only student to mention other subjects among the students classified as having a fragmented conception of mathematics, and he only named science generally as being related to mathematics.

Isaiah, Wendy, Wesley, and Zohelia's conceptions of mathematics all showed signs of moving towards cohesive conceptions. Isaiah and Zohelia both verbalized the idea of mathematics as embedded and central in the world and understanding it, and they, along with Wesley, saw its interdisciplinary role. Wesley and Wendy also demonstrated an awareness of mathematics being involved in understanding and shaping complex structures in the real world outside of their own lives. All four also gave examples of mathematics in the real world that went beyond the typical and obvious examples that most students gave. The evidence is not strong enough to be able to assert that these students hold definitive cohesive conceptions of mathematics; the rhetoric of mathematics being central and interdisciplinary were not accompanied with explanations, and the many of the examples of real-world contexts involving mathematics students provided were closer to creative applications of mathematics rather than examples of modeling. However, these four students demonstrated a broader and more complex view of mathematics and its relationship with the world than the limited one of their peers.

### **School Mathematics and The Real World**

The students at the LCLC diverged from the students at Hewitt in their perspectives about the relationship between school mathematics and the real world. Whereas the students at Hewitt were close to evenly split between having dual and non-dual views of mathematics, the majority of the students at the LCLC expressed dual



views. At the LCLC, even students with cohesive conceptions of mathematics held dual views of mathematics and were critical of school mathematics, though they had different reasons for these criticisms. Because of these differences, I first present the non-dual views of mathematics for students with fragmented and cohesive conceptions of mathematics, then the dual views of mathematics for students with fragmented conceptions, and finally the dual views of mathematics for students with cohesive conceptions of mathematics. A summary of students' conceptions of the role of school mathematics is found in Table 9.

Table 9

Role of School Mathematics Beyond Basic Applications, LCLC

Role of school mathematics	Fragmented Conceptions	Cohesive Conceptions
<u>Mathematics as dual</u>		
Academic advancement, only	1	1
Knowledge, only	5	-
Depends on career	4	-
Mathematics in school is inauthentic	-	1
<u>Mathematics as non-dual</u>		
Just in case	3	1
General	-	1

*Non-dual views of mathematics.* Five of the 17 students conveyed a view that the mathematics they learned in school was connected to the mathematics in the real world, three with fragmented conceptions (Evelin, Nila, and Shaquan), and two with cohesive conceptions (Isaiah and Zohelia). Zohelia insisted that the mathematics in school and in the real world were the same, stating her belief that “numbers won’t change.” The rest of the students alluded to the possibility that any of the mathematics they learned in school could turn out to be useful in their lives, but the statements they made were vague. Isaiah

and Shaquan, for example, both stated that it is good to know mathematics “just in case” without further elaborating on what these cases might be. The students were unable to articulate ideas how mathematics could be useful in the real world, whether for themselves or others.

*Fragmented conceptions and dual views of mathematics.* As many as 10 of the 13 students with fragmented conceptions of mathematics expressed that there were only certain topics in school mathematics that they considered useful or relevant in the real world while the rest were not. Students made sense of the duality of mathematics in different ways.

Five students conjectured that school mathematics could prove to be useful depending on one’s career. These students explained that the mathematics they might not consider as useful in the present might turn out to be useful in some unimagined future. By doing so, students distanced themselves from possible careers with which they did not identify. Lara and Marcos made general statements towards this idea but Hector, Lisa, and Raul specifically referred to careers as scientists and mathematicians. In all three cases, the students positioned these careers as being out of the realm of their own realities. Hector stated that he assumed that mathematics is for “advanced people,” like scientists, and similarly, Raul stated, “Maybe if you were a scientist but not a regular person in everyday life.” Lisa explained that only mathematicians would need to learn mathematics beyond what is practical for most people, but that she herself would most likely forget everything she learned after finishing college. In fact, Hector and Lisa both mentioned needing mathematics for college, which became the only reason to learn it.

For Lisa, the split between her reality and the reality in which one would need to know all the mathematics learned in school sparked a skeptical view of learning mathematics. When asked about the reason she believes mathematics is taught in school, she replied, “To bore you to death? That’s all I could think. Bore you half to death.” One other student with fragmented conceptions expressed a skeptical view. Bianca did not name any possible reasons for learning mathematics beyond what she viewed as directly applicable; instead, she conjectured that mathematics was taught in schools to occupy students’ time.

Four students saw mathematics as valuable for contributing to one’s general knowledge, regardless of its relevance in the real world. Xavier explained that mathematics helps “to get your brain smarter,” while Edwin described it as “more chances to learn something,” and Felipe and Lance touted a mantra of knowledge for the sake of knowledge. These students also mentioned the importance of mathematics for college, but unlike Hector and Lisa for whom it became the sole reason, the connection between mathematics and knowledge was made more meaningful. For example, because of his esteem for knowledge in general, Lance linked attaining credentials with advancing oneself as a person: “It’s [mathematics] just knowledge period. Knowledge is knowledge. Who wants to go nowhere with themselves? Even though it’s a GED, it’s not a degree or a high school degree, it’s the first step, you know what I’m saying?” Finally, Felipe also elaborated that mathematical knowledge “goes way back to the Aztecs and the Incas and the Mayas,” suggesting a cultural connection to this body of knowledge.

*Cohesive conceptions and dual views of mathematics.* Wendy and Wesley were the two students with cohesive conceptions of mathematics who saw a clear separation between the mathematics presented in school and the mathematics they saw as relevant in the real world. Wendy, much like Bianca and Lisa, adopted the skeptical view that only basic mathematics was actually relevant to learn. Wendy saw mathematics as embedded in the world, but this did not mean that all mathematics was included; according to her, the rest was only taught “because it’s part of the curriculum that the board of education tells you.” Her focus on the role of mathematics in understanding real-world issues like the city budget led her to dismiss mathematical topics that she saw as irrelevant to addressing such issues. In contrast, the students with fragmented conceptions who were skeptical of school mathematics were focused on the irrelevance of mathematics beyond basic operations for practical use in their own lives.

What Wesley saw and loved about mathematics was not necessarily the mathematics he saw as being taught in schools, and he blamed ineffective teaching for the disconnect between mathematics in and out of school. He went on to present a vision of mathematics education in which mathematics was embedded in real-world activities, consistent with his conception of mathematics as integrated in the real world rather than separate and applied externally.

Wesley: I just think you don’t think about math when you’re outside of school. I think people think about math only when they’re in school.

Vivian: Why do you think that is?

Wesley: Well, because when they see math, like, they think of it as this big piece of paper of never-ending numbers. They don’t actually think of it as everyday useful things. I don’t know. I guess... I think schools should do outside activities with math. Like I think if they had a hands-on, like, math class, like actually build a playground type thing, you gotta build it yourself, or they give you little Jenga pieces kind of

thing, you have to build something, they want to say, ‘How big is this house if you’re going to make the house over there?’ I think that would get me more involved in math. I mean I love math, but I think to more involve me is to have me doing something instead of having me stare at a piece of paper with numbers.

Wesley saw the mathematics in school as a false representation of mathematics that did not match his own conceptions of mathematics and that distorted other students’ conceptions of mathematics as well. Unlike his peers, Wesley saw the duality of mathematics as a result of a poor translation of real mathematics into classroom learning rather than as a separation between the mathematics content that is taught in school and the mathematics that is actually relevant and meaningful in the world.

*Summary.* Although students generally believed in the importance and usefulness of mathematics in the real world, they did not necessarily believe that the mathematics they were learning in school was important. The majority of students who were categorized as having fragmented conceptions of mathematics and half of the students categorized as moving towards cohesive conceptions of mathematics described a duality in their views of mathematics. The ways that students from the two groups explained this duality were nuanced and tied to their conceptions of mathematics. Whereas the students with fragmented conceptions of mathematics simply dismissed school mathematics as not being useful or applicable to their lives, students moving towards cohesive conceptions of mathematics like Wendy and Wesley were critical of school mathematics for not better representing the real-world mathematics they believed was valuable and useful to learn.

### **Mathematics and Citizenship**

As with the students at Hewitt, in this section I present how students at the LCLC saw the role of mathematics in citizenship, then I discuss how the findings about

students' conceptions about mathematics shows how students understand the role of mathematics in citizenship. I argue that the LCLC students' maturity and life experiences made them more inclined to give more grounded responses about the role of mathematics in the world and in citizenship, which can support more real but also more skeptical perceptions of the connection.

*Student perceptions of the role of mathematics in citizenship.* Students at the LCLC were mostly unable to make a connection between mathematics and citizenship. When asked if they thought there was a relationship between mathematics and citizenship most students simply stated, "I don't know," "No," "Not really," and even "I don't see how it could." Like at Hewitt, students' fragmented conceptions of mathematics likely did not match up with their ideas about citizenship. As one student, Lara, explained, "I don't think you need to be... you need to know math to be a good person, to help around. I don't think so." However, even Wesley, who had exhibited the strongest cohesive conceptions of mathematics, did not make a connection. Wesley even attempted a joke to avoid answering the question about whether mathematics has any relationship to citizenship: "One person plus one person can help another person. That was a good one, right? I got jokes."

Five students did make a connection between mathematics and citizenship, and most of their explanations reflected their conceptions of citizenship as well as their conceptions of mathematics. Raul, drawing on his conception of mathematics as simple arithmetic applied in daily life situations in combination with his conception of citizenship as primarily being responsible and taking care of oneself, described doing taxes and performing basic functional tasks as activities of citizens supported by

mathematics. Lisa linked her fragmented conception of mathematics as applying numbers, counting, and simple operations to her conception of citizenship as organizing community events: “If you’re like printing out flyers, how many am I going to have to print out to give to every house or something like that. Other than that, I really... [trailed off and did not finish sentence].”

The other three students who related mathematics to citizenship were students with cohesive conceptions of mathematics: Isaiah, Zohelia, and Wendy. In line with his personally responsible conception of citizenship, Isaiah said that mathematics can keep him busy and away from engaging in deviant behaviors outside of school, but he did not allude to aspects of mathematics as modeling. Inversely, Zohelia stated her belief that mathematics is necessary for understanding “anything in the world” as a way to explain the relationship between mathematics and citizenship, but she did not elaborate with more specific information that alluded to her conception of citizenship. Finally, Wendy was the only student who connected her sense of mathematics as embedded in the world with a justice-oriented perspective of mathematics. As stated earlier, Wendy referred to managing the city’s debt and understanding “how we spend our money as a city, not just individually” to explain the importance of mathematics in supporting what she considered a role for citizens. She believed that it was important for citizens to be aware of the way that the city budgeted its money in order to demand that the money be distributed in ways that were meeting the needs of the underserved rather than projects she saw as less important like beautifying the city.

Like at Hewitt, most of the students at the LCLC did not see a relationship between mathematics and citizenship. However, when they did, they made more direct

links tied to their conceptions and gave examples that were less forced. Rather than creating scenarios about, for example, quantifying good deeds, the LCLC students were more practical and realistic, regardless of the conception of citizenship they were representing. Their examples included paying taxes (personally responsible), counting flyers to distribute about a neighborhood event (participatory), and understanding a city's budget (justice-oriented). Another similarity to the findings from Hewitt is that the students with cohesive conceptions of mathematics were more likely to see a link between mathematics and citizenship, though this connection was not guaranteed.

*The hidden role of mathematics in citizenship.* Although not all students saw the role of mathematics in citizenship, it was clearly present in students' conceptions of the role of mathematics in the real world and their views about the purpose of learning mathematics. Like at Hewitt, money, careers, everyday tasks, and other academic subjects were the main types of examples, reflecting a view of mathematics as serving a purpose that aligns with personally responsible conceptions of citizenship. The students at the LCLC were more grounded and realistic in their examples, however, usually referring to what they actually know about jobs involving mathematics rather than making assumptions the way that students at Hewitt did (i.e., Darius's example of a doctor needing algebra to avoid killing people). The students at the LCLC were also more careful about linking mathematics to careers, often stating that the relevance of mathematics depends on what the career is. Unlike the students at Hewitt, only one student at the LCLC mentioned using mathematics to avoid being cheated. At the LCLC, the students were more measured about stating the role of mathematics in the real world.



For the students at the LCLC, the role of mathematics in fulfilling their tasks as personally responsible citizens (i.e., paying their bills, working, measuring milk to feed their child) were more real. However, this also meant that the students at the LCLC were more aware of the ways in which the mathematics they learned in school was not relevant to the real world, as reflected in the greater proportion of students at the LCLC with dual views of mathematics than at Hewitt. The students at the LCLC were more keenly aware of the gate-keeping role of mathematics, not just in terms of advancing academically but also in terms of pursuing a career. Unlike the students at Hewitt, several students at the LCLC who talked about the purpose of learning mathematics in schools for possible careers expressed dual conceptions of mathematics because they saw these careers as not being part of their own realities. Even students with cohesive conceptions of mathematics saw a split between school mathematics and the mathematics of the real world. These students were vocal about criticizing the way mathematics is taught in schools, envisioning better approaches to encourage a connection between mathematics and the real world. The LCLC students saw the role of mathematics as excluding them from full participation in society and the real world rather than as a pathway towards education and opportunity that many of the students at Hewitt portrayed.

### **Learning from Student Conceptions of Mathematics Across Cases**

Comparing students' conceptions of mathematics and its relationship to the world across cases, we learn that students are learning a version of mathematics that primarily supports personally responsible citizenship. In this section, like in the previous chapter, I look across the settings to discuss implications of the findings about students' conceptions of mathematics and its relationship to citizenship. Then, I discuss the

possibilities presented by the findings about students with cohesive conceptions of mathematics, in particular modeling conceptions, to empower students as more than personally responsible citizens through mathematics.

### **Mathematics for personally responsible citizenship**

The differences between the students at Hewitt and the students at the LCLC can be seen as a foretelling of the evolution of students' conceptions as they get older and gain more life experiences. Students at the LCLC were more likely to give examples of mathematics in the real world that were grounded in reality and to separate school mathematics from the mathematics relevant to the real world and their lives, even students who both enjoyed and saw themselves as successful with mathematics like Wesley. Many of the students at Hewitt who had non-dual views of mathematics believed that the relevance of mathematics might reveal itself in possible future circumstances; but the opposite may be true, as greater life experience may only trigger a greater awareness of the duality of mathematics as youth continue to fail to encounter experiences in which mathematics is involved in their lives. Of course, the students at the LCLC are a small subset of youth. The students at Hewitt may indeed grow up to strengthen their non-dual conceptions by witnessing the power of mathematics in their lives either through or in spite of their experiences in school. However, the frequency with which the students at Hewitt made vague statements about the importance of mathematics or offered forced examples of the relevance of mathematics indicates that even the students at Hewitt who believed in a strong connection between mathematics and the real world were basing their faith on an unstable foundation.

In addition, the findings from the LCLC at the very least reveal that for youth who disengage from school for one reason or another, for the most part they leave with the sense that school has not empowered them with the mathematics they will encounter in the real world. As these youth attain or pursue jobs, they learn that mathematics is reserved for those who obtain specific professions requiring advanced mathematics, and therefore that mathematics is not for them. For these students, mathematics has been limited to teaching them how to be functional citizens, fulfilling basic duties of everyday life, especially in terms of navigating finances. Beyond the application of basic operations, mathematics has been solely serving the role of gate-keeping to aid in the sorting of people into careers and life stations. Thus, mathematics has only reinforced personally responsible citizenship, sending the message to youth that what is important is to learn the skills to navigate and fulfill the responsibilities of life, including attaining gainful employment to contribute as an economic citizen. Youth have not learned about how mathematics can empower them to change the world outside of their own individual lives.

### **Possibilities of critical mathematics for empowering citizenship**

We do see promises of a greater connection between mathematics and the world and, consequently, mathematics and citizenship for students with cohesive conceptions of mathematics. Across both settings, almost all of the students with cohesive conceptions at the very least attempted to articulate a relationship between mathematics and citizenship. In particular, this is true for students who demonstrate characteristics of the modeling strand of cohesive conception rather than the abstract. At Hewitt, Jesse and Rashida showed abstract conceptions of citizenship to different degrees, and they

appreciated mathematics as being more than just mechanical applications. However, they struggled to make genuine connections between the mathematics in school and in the real world. Jesse in particular expressed that mathematics can aid in solving complex problems, but he had more ease with thinking about problems from a purely academic standpoint.

On the other hand, Reggie from Hewitt along with the four students at the LCLC aligned more strongly with a modeling conception, which defines mathematics as embedded in the world and as a means to understand it. However, seeing a connection between mathematics and the real world did not necessarily translate to envisioning a role for mathematics in citizenship. Wesley demonstrated the strongest cohesive conception of mathematics, including elements from abstract and modeling approaches, and was vocal in advocating for a more realistic experience of learning mathematics in the classroom. Still, Wesley could only make a joke about how mathematics relates to citizenship. Part of this could be because he was thinking in terms of personally responsible citizenship, and he could not imagine how mathematics played a role in someone being a good person.

Having a cohesive conception of mathematics also does not necessarily translate into seeing a meaningful role for mathematics in citizenship, as evidenced by the vague, general statement made by Zohelia that mathematics is connected to everything, or the indirect link Isaiah made between mathematics and citizenship by suggesting that mathematics can keep youth occupied and away from engaging in socially deviant behavior. Reggie and Wendy were the only students who described mathematics as empowering citizens to engage in making meaningful change, Reggie in terms of

empowering citizens to plan and build institutions to help people, and Wendy in terms of empowering citizens to understand and fight for city budgeting that serves people in a meaningful way. The converse was also true for Wendy: enacting citizenship—in her case, justice-oriented citizenship by examining inequalities in systems—heightened her awareness of the importance of mathematics beyond its applications to her life as a personally responsible citizen. Of all of the students with cohesive conceptions of mathematics, Wendy was the only one who was neither enthusiastic about mathematics nor schooling in general, and she described herself as unsuccessful at mathematics in school. However, a critical approach to examining the world brought out the potential for mathematics to empower her as a citizen who can make change in the world.

## **CHAPTER 6: SOCIAL JUSTICE MATHEMATICS FOR CITIZENSHIP**

### **Introduction**

This chapter addresses the third research question: How can a social justice mathematics approach influence youth's conceptions of mathematics and citizenship? The implementation of social justice mathematics looked different at each of the two research sites. At Hewitt, students examined the proportions of vacant lots and basketball courts in their neighborhood compared to other parts of the city through mathematics. At the LCLC, the students were exposed to issues of injustice that related to four main themes: 1) wealth inequality, 2) bullying, 3) the dropout crisis, and 4) stop-and-frisk. The volatility of the program and its enrollment meant that students experienced each of these issues to varying degrees.

This chapter discusses findings from students' reflection on their experiences with the social justice mathematics lessons their teachers and I co-designed. For the students at Hewitt, these reflections took place in follow-up interviews upon the project's completion. At the LCLC, they occurred throughout most of the interviews depending on how many sessions the students had attended and whether a follow-up interview was anticipated. In their reflections, students talked about their experiences learning about the issues with mathematics as well as offering their ideas about how these issues could be addressed.

I begin the sections for each site by providing more details about the mathematics curriculum their teachers and I co-designed. I then address the research question by examining how students' experiences with social justice mathematics lessons interacted with their conceptions of mathematics and their conceptions of citizenship. I address

these questions not by analyzing new definitions of mathematics and citizenship, as most students reported little or no conscious change in these, but by analyzing how the students drew on and talked about mathematics as well as how they talked about addressing the issues they examined. Through such analyses, we can learn about whether and how the social justice mathematics lessons engaged students in thinking about the role of mathematics in their world differently, and whether and how the project engaged students in thinking about approaches to addressing issues in their community differently. I conclude the chapter with a summary and discussion of implications about the potentials and challenges of a social justice mathematics approach in empowering youth as citizens.

### **Examining Vacant Lots and Basketball Courts at Hewitt**

#### **The Curriculum**

*Planning the citizenship project.* The social justice mathematics lessons that the teacher and I co-designed were created as part of a larger project for the eighth grade students. Diana was in charge of heading up the eighth grade final project, a multidisciplinary project based on a theme of her choosing. Because of my interest in citizenship, Diana decided that the theme would be citizenship. Diana planned all non-mathematical components on her own, including writing assignments and having students recite Nguzo Saba, the seven principles of Kwanzaa, as her approach to teaching her students about what it means to be a citizen (See Figure 6). For the mathematics component, Diana wanted her students to learn about their own neighborhood as well as about different neighborhoods across the city. Diana chose 10 zip code areas in the city that she felt would give the students a sense of the broad range of the population of the

city in terms of demographic characteristics, such as race and income. Although the zip code areas do not map onto the delineation of neighborhoods that are well known to city residents, they serve as a proxy, and I henceforth refer to them interchangeably as either zip codes or neighborhoods, as many of the students did.



Figure 6. Nguzo Saba: The seven principles of Kwanzaa (Karenga, 2008).



In the planning of the mathematics component, referred to here as the vacant lots and basketball courts project, the teacher and I met weekly throughout the course of the fall and spring semesters. In our discussions, we had decided that the mathematical standards that were appropriate for the eighth grade were ratios, which are a significant component of the middle school curriculum, as well as geometry topics such as finding areas and perimeters, which Diana identified as standards that many of her students would benefit from reinforcing. Based on these ideas, we created a mathematical investigation of the distribution of resources in students' communities. The specific topic of vacant lots and basketball courts was decided in part through input from the students. Diana and I surveyed the students about the types of places that they would like to see more of in their communities (i.e., parks, playgrounds, bookstores, sports fields, etc.) and the types of places they would like to see fewer of (i.e., liquor stores, bars, vacant lots, etc.), with space for students to write in additional answers. Considering student responses, the availability of data, and how well the data would fit with Diana's mathematical goals guided our choice of vacant lots and basketball courts as the subjects of study. The distribution of vacant lots was particularly relevant to the immediate neighborhood of the school. I had found public data with all of the addresses of the vacant lots in the city and found that the lots with a zip code matching the school's zip code significantly outnumbered those in other zip code areas of the city (See Figure 7). The next subsection outlines details of each session of the project.

*Class sessions.* The vacant lots and basketball courts project was implemented over 10 class sessions. The sessions can be broken up into three main parts: 1) exploring the demographics of the city's neighborhoods, 2) representing the distribution of vacant

lots and basketball courts based on the areas and populations in the city's neighborhoods, and 3) forming opinions about the role of the community in addressing issues.

Throughout the project, the data focused on the ten focal zip codes chosen by the teacher, and reflective writing assignments, called journals (all designed by Diana and assigned outside of the mathematics classes) were given to students in between or sometimes as a way to launch or reflect on mathematics lessons (See Table 10).

Table 10

Journal Prompts for the Citizenship Project at Hewitt

Scheduling of assignment	Journal assignment question prompt
Following sessions about demographics of the city	Based on the racial makeup of the whole city, which one of these [10 zip codes] best represents the city?
Following introduction of vacant lots and basketball courts topic	What are your feelings as you look at the vacant lot? Think about three positive possibilities that could happen to a parcel of land. Now think of three negative outcomes for the lot.
Prior to concluding session	Our community is as it is because... A) It was designed this way. (Not enough money is funneled in; there are no plans for development.) B) The residents don't care. (People either don't take care of it or help to destroy it.) C) I can't decide. Select one response and give 3 reasons.

Students explored demographic data about the city in several different ways. In the first two sessions, the students were introduced to the demographic breakdown of the ten focal zip codes according to gender and race. The students were given numbers rather than percentages and were asked to find the most and least integrated communities by comparing ratios (i.e., population of Black to White people). The third session provided students with the same data in percent form, along with the median ages and the

average incomes of the population in these neighborhoods. Students made various scatter plots using these data to explore the relationship between demographic characteristics.

BASKETBALL COURTS	Hewitt's Zip Code Area	Zip Code Area B	Zip Code Area C	Zip Code Area D
Total Population	36,572	43,183	9,808	34,196
Ratio of people to basketball courts (as a fraction)	$\frac{36572}{9}$	$\frac{43183}{7}$	$\frac{9808}{2}$	$\frac{34196}{4}$
Find the ratio of <i>people per court</i> by dividing (use a calculator)	$\frac{9069}{1}$	$\frac{6169}{1}$	$\frac{4904}{1}$	$\frac{8549}{1}$

VACANT LOTS	Hewitt's Zip Code Area	Zip Code Area B	Zip Code Area C	Zip Code Area D
Total Population	36,572	43,183	9,808	34,196
Ratio of people to vacant lots (as a fraction)	$\frac{36572}{2255}$	$\frac{43183}{476}$	$\frac{9808}{7}$	$\frac{34196}{27}$
Find the ratio of <i>people per lot</i> by dividing (use a calculator)	$\frac{16.218}{1}$	$\frac{90.721}{1}$	$\frac{1401.193}{1}$	$\frac{1266.519}{1}$

Figure 7. The ratio of people to basketball courts and vacant lots (Sample student work).

In the fourth session, the topic of vacant lots and basketball courts was introduced. Students were a numbered list of addresses of the vacant lots and basketball courts for the ten focal zip codes in the city. Using these data, the students spent three sessions analyzing the ratio of people to vacant lots and people to basketball courts for the various zip codes (See Figure 7). In the following three sessions, students figured out the ratio of area, in square feet, to the number of vacant lots and basketball courts for the

ten focal zip codes. The students estimated these areas by inscribing and measuring polygons in a map showing the zip code boundaries and using the map's scale to convert the dimensions. The students also had an assignment in which they calculated the area of their school's block to get a sense of the ratio of blocks to vacant lots and basketball courts. On the final day of the project, the students held a debate to summarize students' ideas about citizenship in relation to the issue of vacant lots in their neighborhood. To prepare the students for the debate, Diana gave the students a writing assignment prior to the lesson (See Table 10).

### **The Relationship Between Mathematics and the Real World**

This section explores how students' engagement with the issue of vacant lots and basketball courts project at Hewitt affected their conceptions of mathematics and their conceptions of the relationship between mathematics and the real world. I explore this question from two angles: 1) How did students experience the role of the issue in learning mathematics? 2) What role did mathematics play in students' learning about the issue? Through the first question, we can learn about students' perceptions of how real world contexts fit into the learning of mathematics. Through the second question, we can learn about how students relate mathematics to the learning of real-world issues.

*Vacant lots and basketball courts to learn mathematics.* Examining how students perceived the role of the issue of vacant lots and basketball courts in their learning of mathematics provides insights into students' conceptions of mathematics and its relationship to the real world. This section analyzes how students saw the contextual focus as contributing to their mathematics learning and whether they saw this focus to be integrated with or separate from the mathematics. This section also highlights student

reflections on the mathematics they experienced in the class and how their experiences influenced their conception of mathematics. Through these analyses, we gain an understanding of how students' experiences examining a problem in their communities through mathematics reflects and affects their conceptions of what mathematics is and how it relates to the real world.

Students saw the context as playing an important role in their learning of mathematics. For many students, studying their neighborhood and its vacant lots and basketball courts served to engage them in mathematics in a way that other contexts might not. Shanelle said, "It was something that I was into it, interested in, and it just caught my full attention." Four students—Andre, Devon, Ferrell, and Qadira—juxtaposed the project to mathematics problems about fish, marbles, or other "random" and "false" contexts to highlight that the project dealt with a subject that was real and relevant to them, and Emmett and Yasir specifically said that looking at their community was what they liked about the project. Calvin projected this interest to his whole class: "Usually, everybody be loud, but it was kinda... everyone was getting along 'cause everybody wanted to find out how... how many vacant lots in [this neighborhood]." Like Calvin, Reggie described mathematics as a means to address an authentic question: "I got a better understanding instead of just doing math, like multiplying. I had to multiply something to find out something I wanted to learn." These students were able to see that mathematics can be tied to contexts that are meaningful to them, not just for learning in school. However, seeing that mathematics could be tied to something meaningful did not necessarily mean that they saw mathematics as embedded in the context. For example, Qadira said she saw the project as "gettin' two for one" because she was learning about

“math and outside inside one problem.” Andre, Calvin, Devon, and Shanelle said that their definition of mathematics was the same as before the project, except with an expanded list of applications that included vacant lots and zip codes.

Other students were more explicit about seeing mathematics and the context as separate. Two students described having any context as important to their learning because it made the mathematics more palatable and more accessible to understand. Reanna emphasized that the key feature was “not just being math” that helped her engage with the lesson; similarly, Jorel said that if he were presented with ratios “on a sheet of paper on a test” (i.e., divorced from context), then he “wouldn’t be able to get it.” Three students dismissed the importance of the context altogether. In terms of learning mathematics, Rashida said that the context “could have been anything,” while Jada said that not having a context “wouldn’t have been different.” Cienna said that the mathematics was not at all necessary for her to have learned about the vacant lots in her neighborhood.

On the other hand, there were students whose ideas about mathematics were affected through their experience in the project. Alisha and Valerie both felt that through the project, they saw what mathematics might be like in the real world in the future. Alisha described the work she did in the project as more complex than what she normally did in a typical mathematics class:

It’s just that regular math is just addition, subtraction, ratio... we don’t have big packets like this when we’re doing math, we have simple papers. We don’t have... the papers to say how many there is or how many there are, or you gotta do this to figure out the ratio, you gotta do that to figure out how much it is. And it’s just higher up than... higher up than math.

This statement at first seems like a commentary on the difficulty and complexity of the assignment itself. However, she then went on to explain that by “higher up,” she meant that it would prepare her for high school, where she might want to “join a flower shop” to plant a garden in a vacant lot and “start it from there.” The link between the complexity of the project and what she might do in the real world shows that she viewed addressing a real-world problem as an involved process that requires more than just the straightforward work she normally experienced in a mathematics class. Valerie also said the mathematics in the project was different from what she normally experienced in class. Although she did not elaborate on what features she considered to be different, she conveyed that she saw the mathematics in the project as more authentic: “Seeing how the real-world math problem was, it helped me more because when I get older I’ll have to do the same thing.”

In their initial interviews, both Alisha and Valerie had stated a belief that all of the mathematics they learned in school would be applicable to the real world. In reflecting on the project, the students differentiated between mathematics in school and the real world. However, the differentiation was not based on seeing an inapplicability of certain topic in mathematics, as most of their classmates with dual conceptions of mathematics had expressed. Instead, Alisha and Valerie were recognizing that something about the mathematics in the project was fundamentally different from what they normally experienced in mathematics class that was closer to what mathematics in the real world was, which they believed they would experience in the future. Alisha’s reflection, in particular, is reminiscent of that of Wesley’s opinions about school mathematics from the LCLC. Although Alisha did not critique school mathematics the way that Wesley did,

her recognition of the complexity of mathematics for addressing problems in the real world as contrasting the simplistic treatment of mathematics in school is a step towards seeing mathematics as more than a collection of components.

For two students, their experiences in the project prompted a change to their definition of mathematics. Ferrell, like several of his classmates, refined his definition of mathematics by extending his purview of contexts in which he saw mathematics as applicable to include issues like vacant lots. But Ferrell also went further than his classmates, in that he also saw a different type of role for mathematics in the context of vacant lots:

Vivian: Is there anything that you would change or add to your definition of math?

Ferrell: Yeah... you can use math to like... to help out in the area, knowing the vacant lots, different amount of people, trying to solve that issue, different things.

Vivian: How do you use math to solve that issue?

Ferrell: 'Cause you can like go to the council or something and tell them that it's 16 people to every vacant lot or something like that.

Vivian: I see. So knowing the math gives you something to say.

Ferrell: Yeah, a statistic to tell them.

For Ferrell, mathematics provided not just a way to apply procedures to arrive at an answer, but rather the mathematics—in this case, the ratio representation—served a powerful social role of making change. Ferrell recognized this shift himself: “I thought math is just like... things involving math like money and all those different numbers. I didn’t know you could use it in your community.” Aside from Ferrell, Emmett, who had in his initial interview defined mathematics as “a concept dealing with numbers” and could only make a vague connection between mathematics and science, now said that mathematics is “life lessons.” Although Emmett was unable to articulate what he meant



and was not specific like Ferrell, his response reflects a sense that mathematics is intricately tied to the real world, not just in terms of applicability but also in terms of meaningful learning in his life.

Engaging students in learning mathematics through an examination of vacant lots and basketball courts in their neighborhood reflected and influenced how the students perceived the role of mathematics in the real world. Students' conceptions of mathematics as fragmented filtered how students perceived the project; many of the students described the mathematics as separate from the context rather than embedded in it. This included Rashida, who had shown evidence of a cohesive conception of mathematics (Unfortunately, there was not enough evidence from Reggie or Jesse's interviews to ascertain their views). However, the project also broadened students' experiences with mathematics and, for some students, strengthened the link between mathematics and the real world. Although it would be farfetched to say that students' conceptions of mathematics transformed from fragmented to cohesive conceptions over the course of their experiences in the project, some students expanded their ideas about the types of contexts in which mathematics could be applied and also the types of purposes mathematics can serve, not just for the individual but for society.

*Mathematics to learn about their neighborhood.* This section details the role that mathematics played in students' learning about their neighborhood and about the distribution of vacant lots and basketball courts. As students described what stood out to them from what they learned, they talked about mathematics in several different ways. Most students focused on what they learned by having access to real data about the demographics of their neighborhoods and about the vacant lots and basketball courts in

their neighborhoods; some of these students reflected on how this data related to their own experiences. Other students described what they learned and in those descriptions made comparisons across data, referred to ratios, or related variables in order to convey their points. In other words, in describing their learning, students' focus was not on arriving at numerical answers to problems but on interpreting what these numbers mean in understanding their world.

Simply being given real data helped students to learn about their city and their neighborhood. Nine students said they learned new information about the demographics of their city and its various neighborhoods, and sixteen students said they learned about the quantity and distribution of vacant lots, of which six also mentioned learning about basketball courts. Many of these students simply stated or reacted to the numbers as they described what they learned. For example, Jorel said that he learned that "there are less Asians in a lot of neighborhoods." In terms of vacant lots, Rashida expressed a similar sentiment as many of her classmates when she said, "I thought, wow, I never knew we had so many empty lots! Somebody should do something about that."

Some students made sense of the numbers by juxtaposing them against their own experiences in the neighborhood. Three students compared demographic data to what they knew; two of these students were surprised to learn information that did not match their experiences. For example, Shanelle was surprised by the percentage of Hispanic people in her zip code because she felt she did not herself see many of them. Alisha, on the other hand, said the numbers confirmed what she already knew; regarding the lower proportion of White compared to Black people, she said, "I'm not trying to be racist or anything, but there's not a lot of Whites just walking around." Alisha also engaged with

the numbers to reflect on and interpret real life situations. She conjectured a possible reason behind the higher percentage of females compared to males in her zip code:

“‘Cause there... you know... every time, let's just say, somebody is killed, it's always probably a man. So the level of men in our area is dropping.” Studying demographic data expanded students' knowledge about their neighborhood beyond their experiences while also engaging them in reflecting on these experiences as they interpreted the mathematics. Students also referred to their own experiences as they grappled with the data about the number of vacant lots in their neighborhood. Six students admitted having had a myopic view of the issue before the project, as they had noticed a few vacant lots in the vicinity of their home or school but not realized the problem was so expansive.

Alisha explained the importance of going beyond one's local perspective to understand the magnitude of the problem:

You have to look at the entire picture, and you're gonna see... you're gonna see every vacant lot that there is. You can't look at... oh well, I see a few around my block, I see a few around there. You'll see a few but you're not gonna see the whole picture.

While with regard to learning about demographics, the data served to validate or contradict students' experiences in the neighborhood, in the case of vacant lots, the data pushed students to broaden their perspectives about their experiences. Although the students were aware of vacant lots in their neighborhood, learning the actual number of vacant lots put the scale of the situation into perspective.

Making comparisons across data points furthered students' understanding of not just the absolute but also the relative magnitude of the number of vacant lots in their neighborhoods in a larger context. Four students compared the quantity of vacant lots in

their neighborhoods to other neighborhoods. For example, Jesse said that he found that “there was one that even had seven, compared to two-thousand-something in [our neighborhood].” Jada made a similar comparison, stating that “all other zip codes, [the number of vacant lots] was lesser,” while in the local zip code “it was near 3,000.” She concluded, “And it’s just a shame,” pointing out the irony that while these lots are empty, there are many homeless people who need a place to live. Two other students, Valerie and Yasir, made quantitative comparisons of vacant lots to basketball courts. For example, Valerie said that she learned that in her neighborhood, “they have more vacant properties than basketball courts.” In these comparisons, the number of vacant lots in other neighborhoods and the number of basketball courts served as powerful points of reference that highlighted how rampant vacant lots were in the students’ neighborhood.

Some students also drew on ratios to aid in their processing of quantities. Three of the six students who mentioned basketball courts framed the quantity in terms of ratios. Two students thought there were too few basketball courts in their neighborhood, and they used the idea of ratios to make their point. Reggie, who loved basketball, said, “It’s a minimum basketball courts to each... to each people in our zip code.” Cienna interpreted the idea of a ratio and said, “A lot of people gotta share little basketball courts.” Yasir connected basketball courts to vacant lots and made a similar statement to that of Valerie’s in comparing basketball courts to vacant lots, except he also included a ratio in his argument: “I learned there’s less basketball courts, it’s probably like... 20 people per basketball court and there’s a lot of vacant lots and people are not doing nothing with it.” Although Yasir’s number is far from the actual number and reveals potential confusion about what ratio would be considered good or poor access to a

basketball court, his inclusion of a ratio alongside Reggie and Cienna's allusion to ratios reveals that students made a connection between the mathematical concept and the subject. Three students used ratios to convey what they learned about vacant lots. One of the students, Shanelle, used a ratio to convey the low number of vacant lots in other neighborhoods rather than the high number in hers. Shanelle was not surprised by the large number of vacant lots in her neighborhood, but rather that there exist "places that have like 1 vacant lot to every 100 blocks that you go." Devon also talked about the quantity of vacant lots through ratios of vacant lots to blocks, and he used this construct to compare across places. He explained that seeing a vacant lot every three or four blocks may seem like a lot, but it is not compared to the local neighborhood, where "you see like... every corner, like you go to the corner and it's a vacant lot." The third student, Ferrell, made the generic statement that he learned that "there's so many vacant lots in [our neighborhood] to so many people," without specifying the number.

What all of these instances have in common is that the ratios were utilized in accordance to the context. Students referred to population, not blocks, per basketball court while alluding to number of blocks, not population, per vacant lot, even though both types of locations were explored according to both population and area in the curriculum. A possible explanation is that these pairings made more sense for students to visualize. In particular, although the teacher had students imagine people on a basketball court as well as on a vacant lot, the image of people in a basketball court elicited a greater reaction from students. Although students could imagine both, people on a basketball court was likely a more accessible reference for the students, many of whom played basketball regularly; similarly, seeing a vacant lot for every so many blocks was also a

more natural image than people on those vacant lots. What this implies is that students were calling upon ratios not for the sake of using ratios but rather to make meaning from them in a way that made sense to them.

Only one student made a connection between demographics and vacant lots. Jesse said that in his neighborhood, “there’s a lot of Black people, and it was a lot of vacant lots,” whereas in other places they have “less Black people, and it’s a lot less [vacant lots].” When asked to explain why he thought this was, he explained as follows:

- Jesse: It seems like the Black people don’t care.  
Vivian: Do you believe that?  
Jesse: No. Some people do care.  
Vivian: So what do you think is going on then?  
Jesse: I think that they too afraid to say something, because nobody else would like to do it with them. So they wanna have... so they just be doing it by them self, and they would take too much time for that.

Although Jesse connected the demographic data with data about vacant lots or basketball courts, it is possible that his orientation toward personally responsible conceptions of citizenship drew him away from the idea of injustice embedded in the system. At the outset, Reggie blamed Black people for the vacant lots, which in this case was a generalization for the people in the neighborhood. When pushed further, he shifted the cause to other people not wanting to partner with them along with a fear of vocalizing their needs. This statement still stays in the realm of personal responsibility, as he focuses on the attitudes and willingness of people wanting to help take action rather than on addressing the root cause of the issue. However, he comes closer to a justice-oriented view, pointing to a sense of powerlessness and lack of a voice for the people in his neighborhood tied to a sense that they are alone in a struggle that others are not willing to address or perhaps even acknowledge. For Jesse, making connections between

mathematical analyses prompted a deeper, more reflective look at an important issue in his community.

Jesse was also among four students (along with Andre, Darius, and Reggie) who not only showed how mathematics played a role in his understanding of the issue but also articulated his reflection of this role. Jesse said that whereas in other subjects he can only look at things, by examining the issue in mathematics he was able to know the “exact numbers” and “see everything clearer.” Similarly, Andre said the numbers gave him “more information,” and Reggie said without the mathematics “you’re not getting a full understanding of how much it really is.” Darius extended this idea and said that not only did mathematics help him understand the issue better, but also that now his knowledge was strong enough that he could explain the issue to someone else. These four students were articulating an awareness of the power that mathematics lent them in accessing information and giving them confidence to talk about what they learned.

Although Jesse was the only student who went as far as discussing the relationship between connecting race to the issue of vacant lots, all of the students described in this section embedded data and mathematics in their understanding of a real world issue that was relevant and important to their community. Whether the students were aware of it or not, they showed engagement with mathematics in the form of not just applying procedures to arrive at a numerical answer but representing information about their world. So while the previous section showed a broadening of ideas about mathematics for some students, listening to students talk about the project reveals that students were also engaging with mathematics in a way that went beyond their own fragmented conceptions of mathematics as a collection of facts and procedures utilized to

arrive at an answer. In conjunction with students' broadened experience with mathematics, students' reflections on the project show a potential for a social justice mathematics lesson to prompt students' ideas about mathematics as integral to understanding their world.

### **Addressing the Problem of Vacant Lots in the Community**

In the previous section, we saw that mathematics supported students in understanding the extent to which vacant lots were rampant in their neighborhood, especially in comparison to other neighborhoods and in relation to the number of basketball courts. This section examines how studying the issue of vacant lots in their mathematics class showed potential to empower students as citizens. Like in Chapter 4, this section breaks down how students' ideas about addressing the issue of vacant lots in their community reflects personally responsible, participatory, or justice-oriented conceptions of citizenship, along with whether students viewed these approaches as empowering.

Students' ideas about how to address the issue of vacant lots depended on how they framed the problem; while some students saw injustice in the disproportionate number of vacant lots in their neighborhood, more students did not see the issue as an issue of justice but an issue of responsibility. Therefore, before I can report the personally responsible, participatory, and justice-oriented responses of the students, I first differentiate between students who perceived injustice with respect to the distribution of vacant lots and those who did not. This differentiation is directly linked to the types of responses students gave as ways to tackle the problem of vacant lots in their neighborhood.



*Framing the problem of vacant lots.* There were 11 students who said that the vacant lot situation was unfair. These students were divided into two main ways of thinking about unfairness. Seven of the students focused on the outcome, meaning that they either said that all communities should be the same in terms of cleanliness or number of vacant lots, or that there should not be any vacant lots in the first place. These students did not necessarily think that unfair conditions were the cause of the outcomes, but they thought that something should be done to change these outcomes. The other four students focused on possible unfair causes for creating the disparity between neighborhoods with regard to vacant lots. These four students vocalized a sense that their neighborhood did not have as many resources and received less attention and investment in comparison to other neighborhoods. Unlike their peers, these students were pointing to systemic issues that went beyond the vacant lots themselves.

The remaining students did not believe that unfairness was part of the issue. Most of these students reframed the issue of vacant lots in terms of the cleanliness of the lots and said that it is residents' own responsibility for keeping the lots clean. Qadira went even went as far as blaming the residents for not receiving more assistance.

If I was the president or the city council or something, and I want [this neighborhood] to look this type of way, but I know if I do this, they're gonna do graffiti there, graffiti everywhere, like if I put signs on their buses, they're gonna do graffiti on the bus, if I do paint the new recreation center, they're gonna put graffiti. So what's the point? They're wasting money on us, and they know that we're gonna trash it.

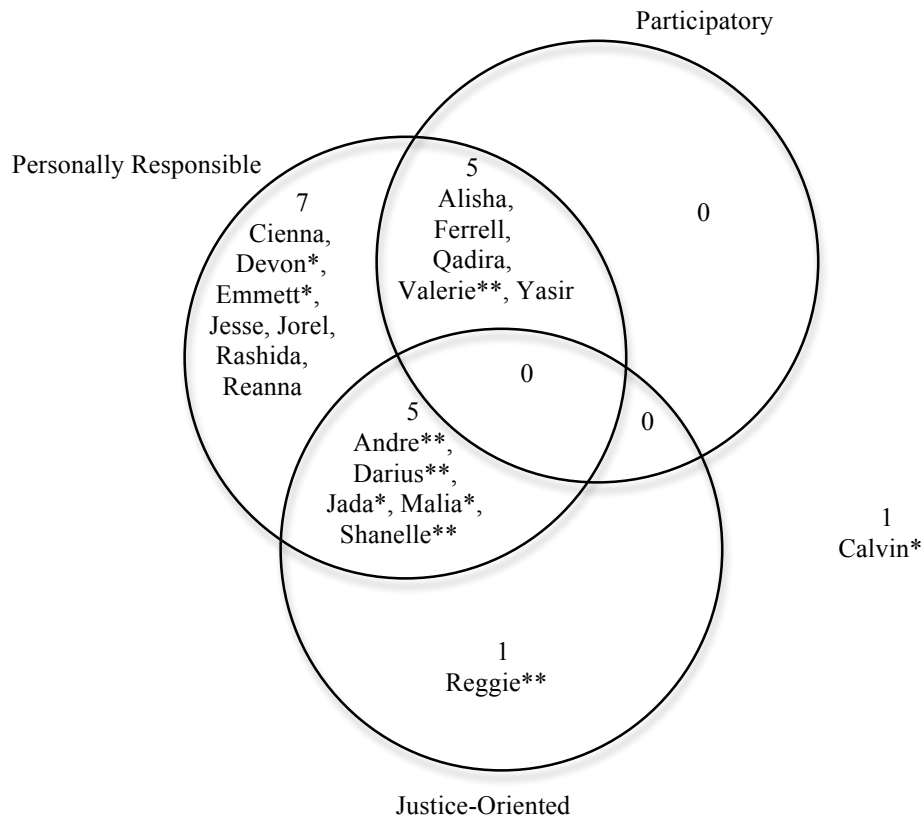
One student, Alisha, did refer to the number of vacant lots rather than their maintenance. However, she did not necessarily believe that vacant lots in themselves were negative: "I don't think it should be unfair because some places have more vacant lots than other

places. But it... it can be fair or it could be unfair, but it all depends on what you do with your vacant lots.” So although she engaged in thinking about the number of vacant lots, she ultimately also turned the issue to be about the state of the lots that determined whether they were a positive or negative features.

Understanding how students framed the issue is important because it is tied to how they thought about ways to address it. Even though the students studied the distribution of vacant lots, what many of the students saw as the issue was the unkempt condition of the lots. However, it is not necessarily that because the students framed the issue this way that they came up with cleaning the lots as a solution; it is also possible that students’ general concern for cleaning their neighborhood led to framing the issue surrounding vacant lots in terms of upkeep. As the initial interviews indicated, keeping the neighborhood clean was already something that was prevalent in students’ ideas about issues to address in their community. Since the curriculum did not directly delve into the causes for the existence and distribution of vacant lots, it is possible that students latched onto a secondary idea about the condition of the lots.

It is reasonable to expect that seeing unfairness is more likely to yield justice-oriented perspectives, but this was not always the case (See Figure 8). Calvin, who said there should not be vacant lots period, did not come up with ways the issue could be addressed because he believed it was up to the owners of the lots and therefore out of anyone’s control. Four other students who believed that there was injustice in the situation only gave personally responsible and participatory responses. It is possible that for these students, too, how they framed the injustice and whether or not they believed it was in their power to address it played a part in shaping their ideas about how they came

up with avenues for making change. The following subsections elaborate on the personally responsible, participatory, and justice-oriented approaches that students came up with to address the issue of vacant lots in their communities, paying particular attention to the responses of students who believed it to be an issue of unfairness.



*Figure 8.* Categorization of students' responses to the issue of vacant lots at Hewitt. Students who described the issue as unfair in terms of outcomes are denoted by an asterisk (\*). Students who described the issue as unfair in terms of causes are denoted by two asterisks (\*\*).

*Personally responsible responses: Transforming vacant lots.* Seventeen students gave personally responsible responses, of which 6 gave only responses in this category. Most of the students (all but 2) included responses about people maintaining the

cleanliness of the vacant lots by either not littering or by helping to clean up. Four of these students also said that people could influence other individuals by telling them to help clean or, at least, to not litter. Two students talked about the possibility of building a garden. As in the initial interview, the idea was that if enough people acted responsibly, their behavior could have a larger positive impact on the community. Jorel even alluded to the population of the neighborhood to make this point, saying that the more people that live in an area, the more people there are to help take care of it.

Another type of personally responsible response, included by four students, was that people in the community should transform the vacant lots into something positive, including buildings, businesses, gardens, recreation centers, or baseball fields. This was not described as an organized community effort but the individual endeavors of residents as responsible citizens or as volunteers. Devon, for example, said that people in the community “could own more” properties and turn them into something useful or positive, while Rashida said that people “could plant trees and decorate the lot.” Note that three of the four students were Devon, Emmett, and Rashida, the three students with only personally responsible responses that also had expressed that there was injustice in the issue surrounding vacant lots. All three of these students were focused on the outcome of the injustice. Emmett thought that there should not be any vacant lots, while Devon and Rashida thought it unfair that some neighborhoods had more vacant lots than others. Because none of these students located the injustice in the causes for the unfair distribution of the vacant lots and instead focused on how to fix the unfair outcomes of distribution, their solution to build or beautify the lots satisfied their idea of addressing unfairness.

However, Devon, Emmett, and Rashida's focus on the responsibilities and actions of the owners of the lot left them with a sense of powerlessness. None of these three students believed that they had the power to change these situations personally. In particular, Rashida reflected on her sense of feeling defeated:

- Rashida: It made me realize how powerless I was.  
Vivian: It made you realize how powerless you were?  
Rashida: Yeah.  
Vivian: How come?  
Rashida: Because people been giving their suggestions to people for years, and nobody's really been listening to them.  
Vivian: How did the project make you realize that?  
Rashida: I realized as I was walking home and looking at the vacant lots. After the project, I realized, is anyone ever gonna fix this?

Despite this lack of hope, Rashida still believed it to be beneficial to have learned about the issue. She said, "I at least know I can do something if I know," and that she cares "somewhat more about this community," though she "can't do it all" as just one person. It was this attitude of wanting to do something as an individual while at the same feeling powerless that perhaps led her, along with Emmett and Devon, to then turn to personally responsible actions like cleaning.

*Participatory responses: Asking for cooperation and for help.* There were two types of responses that were categorized as participatory. One type of response was a participatory version of the personally responsible action of influencing others to take care of the community. Two students, Qadira and Yasir, suggested putting up signs or posters to advertise to the people living in the community to help by keeping the community clean. This suggestion is a reprisal for Yasir, who had said something similar in the initial interview, while Qadira had only given personally responsible responses. The other type of response was voicing the issue to people with power, not as a matter of

addressing injustice but as a matter of asking for help. Alisha, who had suggested something similar in her initial interview with regards to issues of violence in her community, said that protesting “could get us sponsors” that would fund the community’s efforts to transform the vacant lots. The second student was Ferrell, who, as discussed in an earlier section of this chapter, said that numbers would be helpful to bring to convince “the council” to take action. The third student, Valerie, said a “good citizen” would talk to the mayor or someone in a higher rank than the mayor. Like Qadira, neither Ferrell nor Valerie had suggested a participatory response in their initial interviews.

Valerie was the one student in this group who mentioned unfairness in terms of the vacant lots, and she saw injustice in the cause rather than only in the outcome. Although for the most part, Valerie believed that many people in her neighborhood were “being lazy” and not taking care of their community, she said that even when people did do their part in maintaining the neighborhood, their voices were unheard by the mayor when they asked for assistance. Valerie recognized injustice in feeling that those in power were not as responsive to her community as to others. Recognizing this injustice left Valerie powerless; her idea that a good citizen will talk to the mayor despite believing that the mayor is not responsive to people in her neighborhood shows that she viewed the action more as a duty that a citizen fulfills rather than one that will instigate change.

*Justice-oriented responses: “Equaling” the neighborhoods.* Six students gave justice-oriented responses for addressing the issue of vacant lots in the community. However, how students framed the question led to different ideas about what should be done. Andre, Jada, and Malia all discussed injustice in terms of outcomes. These

students thought that it was unfair that their neighborhood had more vacant lots than other neighborhoods, with Jada further arguing that vacant lots were undesirable because they caused their surroundings to be less attractive.

Because their focus was on the number of vacant lots, their ideas about how to make change involved convincing those in positions of power to do something about this number. Andre came up with the following mathematical strategy that he believed the government or mayor should employ: “By counting down all the lots and dividing them into... by two, and then equaling down to every zip code having the same amount of lots by putting houses where the lots are.” This idea was not something that was brought up in class, but his access to the data about the number of vacant lots in each zip code from the project enabled him to come up with a mathematical strategy. Jada referred to the data from the project as useful to making a case; she said, “Well somebody who brave enough could write a letter and tell the people and show them the papers, like there’s too many vacant lots.” Malia’s response was similar to Jada’s; she said she could write a letter, “but you have to be real specific of what you have to know and what you have to do,” and she described the project as helpful in this process because through it, she was able to “find out how many [vacant lots] is there in your community, where you live around.” For these three students, their learning in their mathematics classroom supported them in coming up with ideas for addressing injustice.

The other three students—Darius, Reggie, and Shanelle—focused on inequality behind the disproportionate distribution of vacant lots. These students vocalized a sense that their neighborhood did not have the same opportunities as others. Echoing what he said in the initial interview, Reggie explained that unequal resources (i.e., money) across

communities allow some to be better cared for than others. Darius and Shanelle went even further in implicating a system that privileges some communities over others. Darius expressed a sense that those in power “don’t care about these neighborhoods.” Shanelle pointed to unequal amenities such as recreation centers, quality of schools, and availability of outdoor trashcans as reflections of unequal investment in different neighborhoods. Unlike their peers, these students were pointing to systemic issues that went beyond the vacant lots themselves as the culprits to be addressed.

These three students also suggested addressing these issues by voicing their ideas to people with power, but rather than writing individual letters, all of their ideas involved an organized action. Darius was general and said people can “get a group and go to like... where the people that’s hired to get stuff done around the neighborhood.” In the initial interview, Darius had been one of the students who felt that change in his community was not possible; but he felt that it was possible in terms of the vacant lots because of the new knowledge he had gained from the project. He said he believed if he could talk to the right person, he could convince them “by showing them how many vacant lots is in this... this part, and comparing it with other parts.” Shanelle simply suggested, “Can’t you protest?” Although she felt she was too young to get involved in this way herself at the moment, she said she might consider it when she’s older and expressed a sense of curiosity to learn more: “I wanna know why other neighborhoods are treated different, like what’s the difference?” Reggie was most specific in his plan. He proposed the following:

- Reggie: We could go to other communities and talk to the people that run they communities. Or like...
- Vivian: Who’s we?



Reggie: Um... my community. People that run our community could speak to other community runners, or other community people that... like landlords, and tell 'em about... and show them pictures of where we living at, and they send us pictures of where they living at, and we could take it to the mayor and try to do something about it.

Reggie's proposal was not just reflective of an action but was a particular egalitarian vision of a democracy and society in which "the communities that got good resources could share with the [communities that have] bad resources." This type of vision was something Reggie already had articulated in the initial interview, but applied to the issue of vacant lots as opposed to crime, Reggie did not express the same sense of powerlessness, as he was able to imagine an approach towards addressing the issue, even if a difficult one. Like Shanelle, Reggie felt he was too young to do anything now, but he showed a sense of interest and engagement in thinking about the problems in his community.

Engaging the students at Hewitt in a mathematics project examining the disproportionate distribution of vacant lots in the city sparked justice-oriented responses, something that had not emerged in initial interviews with the students. Among the six students who gave justice-oriented responses, almost all conveyed that learning about the issue in their mathematics class gave them power to voice the injustice, as they felt they had the evidence to make a strong case that would enable them to convince people in power. Even students who came up with participatory responses were empowered by the mathematics to participate in engaging the government to help their communities. This is significant, considering the high dependence on government officials coupled with lack of trust in them that the students at Hewitt had expressed in their initial interviews. However, not all students were empowered by their experiences with the project. About

half of the students still gravitated towards personally responsible and participatory responses that relied on other individuals making personal decisions for themselves. In the case of the issue of vacant lots, some students said that it was the owners of the lots who had to decide to build something positive and productive for the community, leaving little power for others in the community to effect change. Many of the students did not even consider the distribution of vacant lots to be an issue of injustice and chose to focus on cleaning and beautifying the lots, a more tangible way to do something about the vacant lots in their community but certainly a superficial means to address the issue.

### **Social Justice Mathematics at the LCLC**

#### **The Curriculum**

*Planning the curriculum.* Approximately once a week, Olivia's mathematics class had what we introduced to the students as social justice mathematics. In total, there were 29 sessions devoted to social justice mathematics, with two additional sessions serving as introductions to the class to accommodate the student turnover and influx of new students. Olivia and I planned the sessions together, but Olivia taught all the lessons while I participated as an observer. The four themes investigated in the social justice mathematics class were as follows: 1) wealth inequality, 2) bullying, 3) the dropout crisis, and 4) stop-and-frisk. The first two themes were the subject of a few days' lessons, including field trips and presentations. The latter two themes were subjects of longer, more in-depth investigations. A summary of the number of sessions devoted to each theme is shown in Table 11. The table also shows the names of the students who participated across the four themes, along with the number of sessions they attended, prior to the final interview conducted with the student. Note that five students (Bianca,

Felipe, Shaquan, Wendy, and Wesley) did not reflect on the lessons during their interviews because they had experienced very few lessons at the time and a follow-up interview had been anticipated but never occurred. Evelin did reflect on the lessons, but suggesting how to address the issues was not part of her reflection.

Table 11

Mathematics for Social Justice Sessions at the LCLC

Theme	Total Sessions	Students, with number of sessions attended in each theme prior to final interview in parentheses
Wealth inequality	2	Lisa (2), Raul (2), Bianca (1)
Bullying	4	Lara (2), Raul (2)
Dropout crisis	11	Hector (9), Raul (9), Marcos (6), Lance (3), Edwin (2), Wendy (2), Xavier (2), Wesley (1)
Stop-and-frisk	11	Hector (9), Zohelia (8), Nila (7), Marcos (5), Xavier (5), Evelin (3), Felipe (1), Isaiah (1), Raul (1)

*The four themes of the social justice mathematics class.* The first theme of the social justice mathematics was about wealth inequality in the United States, a topic covered heavily in the media at the time as a result of the Occupy Wall Street movement, which protested the enormous discrepancy in wealth between the top 1% wealthiest people in the United States and the other 99% of the population. In the first session, students used mathematics to evaluate the proposal of raising income taxes on the highest-income households. Students performed percent calculations and analyzed various bar and line graphs about income and taxes to learn about the tax contributions of households across income brackets and about historical trends of decreasing tax rates for

the wealthy in conjunction with an increasing wealth gap between high and low income earners. The second session was scheduled on a special programming day as a field trip to witness a rally of the Occupy movement in action. The third session was a later return to the theme in January in recognition of Martin Luther King. The session brought back the idea of income inequality as one of Dr. King's lesser-known fighting fronts, based on an article put out by the *New York Times* newspaper. Students worked in groups to examine several different graphs and visual representations published by the newspaper to better understand income inequality and class (im)mobility.

The bullying theme arose out of Olivia's interest in the topic when the documentary, *The Bully Project*, was featured at a local film festival. Olivia took several students to see the film, which revealed that bullying was a problem that was allowed to exist because of cultural and systemic forces. In the first in-class session, students worked on mathematics problems exploring statistics about bullying. The statistics revealed the prevalence of bullying and the severity of the issue, but it also highlighted its disproportionate impact on certain groups over others, including racial and ethnic groups (Blacks and Latinos more than Whites). In a subsequent session, the students created posters about bullying illustrating salient statistical information through mathematical representations like graphs and charts that the students created. Students had a chance to present their posters to the large new cohort of students who enrolled in December. In addition, two students traveled to a middle school months later to present their posters to a mathematics class who had adopted the materials Olivia and I had created around bullying.

The dropout crisis theme was chosen in conjunction with the students. When the idea of social justice mathematics was reintroduced after the transition and reprogramming in January, the students were asked to brainstorm topics that were of interest to them. The three topics they agreed on were 1) juvenile detention centers, 2) drop out rates, and 3) homicides. Based on this interest, Olivia and I guided the students to design their own investigation about dropout rates. In the first two sessions, the students explored data and read articles about the dropout phenomenon in their city. The data suggested that higher dropout rates often implicated a disinvestment in the education of youth. For example, one article discussed the makings of a school to prison pipeline by revealing that students' 3rd grade standardized test scores were used as a way to predict and plan for the number of jail cells needed in the future rather than for prompting greater investment in learning and school retention. In these two sessions, the objective was for students to brainstorm questions about what they wanted to investigate further and for students to notice that the voices of youths who dropped out, like their own, were missing.

During the following three sessions, students created a survey and focus group questionnaire for their peers at the LCLC. Students first learned about different types of survey methods and questions. Then, they brainstormed questions to ask their peers, categorized them, and ordered them, separating out questions for the survey and for the focus group. The surveys were created and distributed to all of the students at the LCLC, and the students in the social justice mathematics class led a focus group interview with the students in a different class. In the following three sessions, the students focused on tallying the results from the survey and creating pie and bar graphs to represent the

results (See Figure 9). In the final three sessions, students worked on writing pieces synthesizing their findings from the quantitative and qualitative data they gathered.

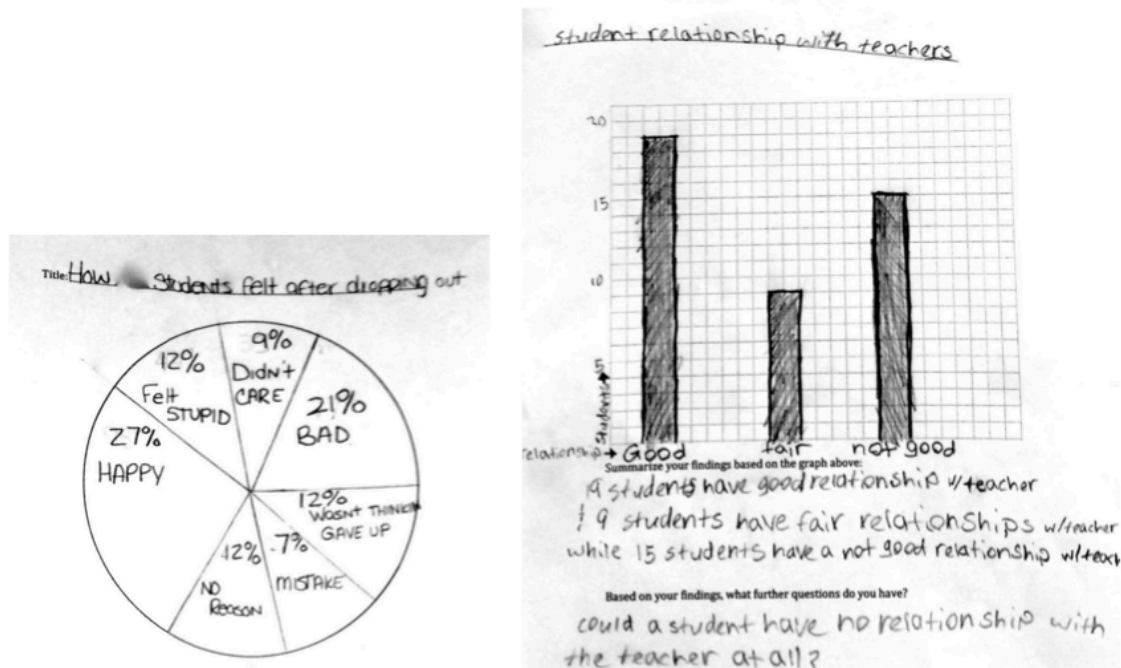


Figure 9. Student-created graphs summarizing survey data about peers' experiences with dropping out.

The final theme, stop-and-frisk, was related to students' interest in juvenile incarceration and was highly relevant during that time period because Trayvon Martin had just been killed. The Trayvon Martin case was used to introduce the topic of racial profiling, and during the first two days, the students worked with ratios and percents to evaluate local data and determine whether the actual proportions of stops according to race matched the proportion of people in those racial categories. The second of those days included a simulation in which students randomly picked cubes that represent people by race to understand the unlikelihood that such a high number of stops for people

of color was a result of chance. Stop-and-frisk was revisited when the New York Civil Liberties Union released an extensive report on the issue using data from the police department in New York City. After initial analysis of the data in the report, three sessions were devoted to employing proportional reasoning to complete and analyze a visual representation that illustrated the disproportionate stops, frisks, and force used during those stops on persons of color, simultaneously with the low numbers of actual weapons found and high rates of innocence. As a supplement to the stop-and-frisk unit, two sessions were devoted to mathematics problems illuminating the high rate of incarceration of Black and Hispanic people in comparison to Whites and its relationship to the punitive sentencing of nonviolent drug offenses. Finally, two sessions were devoted to students preparing presentations about stop-and-frisk, and the final session was a presentation to an audience of adult instructors and staff at the LCLC. The program was in its last weeks at this point, so attendance was low during the presentation preparations, and only one student (Zohelia) ended up presenting.

### **The Relationship Between Mathematics and the Real World**

Students' reflections on their experiences with social justice mathematics can illuminate how students were thinking about the role of mathematics in the real world. This section examines how students experienced the role of the issues in learning mathematics and, conversely, how they saw mathematics as playing a role in learning about the issues. Through these examinations, we learn about how engaging students in social justice mathematics affected students' conceptions of mathematics and their conceptions about the relationship between mathematics and the real world.

*Issues as contexts to learn mathematics.* Students expressed that learning about real-world issues in a mathematics class helped them to learn mathematics. At the most basic level, they felt the issues engaged their interest. However, most students did not see mathematics as embedded in the issues. Some students described the issues as being added to the mathematics class in order to make it more interesting and informative. Xavier and Evelin saw the class as “cool,” but Evelin described the setting of the lesson in context as an “added bonus of learning things that people should learn about.” Other students described mathematics as being manipulated to fit the context. Edwin called the class’s approach “fun” and a “pretty cool idea to get something that interests us and find a way to make it into a math lesson.”

Raul expressed conflicting ideas about the nature of the relationship between mathematics and the issues addressed in the class. On the one hand, Raul was most direct in pointing out his view that the mathematics was contrived for the sake of the class, outright saying, “It’s like, most of it is not math and you guys try to do it, gotta turn it into math.” At the same time, Raul admitted that his experiences in the class expanded his conceptions of the relationship between mathematics and the real world, opening his eyes to new applications for mathematics that he had not considered in the past “because we didn’t know that we can.” In other words, though skeptical of the embeddedness of the mathematics in the contexts presented in the class, Raul began to consider new possibilities for applying mathematics in the world.

Students’ perception that the mathematics and context were being added to each other rather than inherently integrated did not necessarily mean that they did not think the context was relevant to their mathematics learning. In fact, Evelin and Marcos both



described the context as enhancing their learning of mathematics. Evelin appreciated that the context provided concrete references for her to “visualize” the mathematics, “like, ok, that’s young people.” Marcos explained that bringing in a context helped because it was “different” from what he normally encountered in mathematics class: “You can’t just put a paper in front of somebody and make them do math.” According to Marcos, the context provided grounds to explain the mathematics. These views reflect an understanding that the contexts are more than just window dressing for the mathematics, but they do not treat the context as essential to the mathematics as much as serving a referential role. On the other side of the spectrum, Hector saw the context as a hindrance to learning mathematics and thought he could have learned the mathematics better without it.

The view that mathematics was added, inserted, or contrived is in keeping with the students’ fragmented view of mathematics. For these students, applications of mathematics were being combined with issues that were not necessarily inherently mathematical. In contrast, Wesley and Zohelia, with more cohesive conceptions of mathematics, reflected on how the class expanded their awareness of mathematics in the world. Their responses were general about this expansion rather than specific about mathematics for social justice; Zohelia said, “Like you never stop finding new things,” and Wesley said, “You learn math in every day where people don’t see it, so I think it makes people more aware of where math is at.” These comments are in line with the view they had already articulated that mathematics is embedded in the real world; the class’s approach further bolstered this view by bringing to light more proof in novel contexts.

Isaiah, who also had shown evidence of moving towards a more cohesive conception of mathematics, was the only student whose response reflected a change in his conceptions about the relationship between mathematics and the real world. It is important to keep in mind that at the LCLC, most of the students did not have two interviews, so the effects of experiencing social justice mathematics must be observed by seeing a difference in how students talk about social justice mathematics in relation to how they define and talk about mathematics generally or in relation to their previous or other mathematics classes. Isaiah only had one interview, but he reflected on the change himself. Unlike Raul who saw the new contexts introduced in the class as additional applications, Isaiah described the new contexts as revealing a new purpose for mathematics:

Before, I've seen math as, I used to use it like for sports or games or whatnot, but now I really do see math as something that can help our society because it's proven to us, it just showed us our problem . . . And now we notice thanks to math, we notice what was really happening. And that allows us to make a change if you want to make a change.

It was Isaiah's experience in the class that made him realize that his views about the role of mathematics had been narrow in the past. His statement reflects a realization that mathematics is consequential and powerful in changing the world, not just useful for applications and for understanding the world.

With the exception of Isaiah, students' conceptions of mathematics did not reflect a difference when reflecting on learning about social justice issues, and students integrated their experiences in the mathematics for social justice class into their conceptions. Students with fragmented conceptions of mathematics tended to see the mathematics as applied and inserted into contexts, with the contexts providing interesting

and important enrichment and learning opportunities. Students with cohesive conceptions of mathematics tended to embrace the contexts as more examples of the way that mathematics is embedded in the world. Only Isaiah articulated a newfound perception of mathematics and its relationship to the world as a tool for change. Still, the introduction of mathematics for social justice to students showed the potential for challenging students' conceptions about mathematics. As Raul said, even the exposure to mathematics in a context different from what the students were accustomed helped to stretch his consideration for the kinds of contexts to which mathematics could be applied. Using real-world contexts as concrete references to learn mathematics also has the potential to foster connections in student thinking about the important relationship between mathematics and the real world.

*Mathematics to understand issues.* At the LCLC, like at Hewitt, it was evident that mathematics played a key role in students' learning about the issues examined in class. However, the analysis of this role is approached differently for the data from the LCLC in comparison to the data from Hewitt. At Hewitt, students talked about what they learned about vacant lots as they reflected on the issue in the follow-up interview after the project was over. In describing what stood out to them, they showed how they were making sense of the issue using mathematics. At the LCLC, there was some though less evidence of this kind. However, something that the students at the LCLC did that the students at Hewitt did not do as much was to reflect directly on how mathematics played a key role in learning about the issues and how that related to their lives. With that in mind, this section describes the various ways in which mathematics played a key role in

students' understanding of the issues, including how students saw mathematics as playing this role in relation to their lives.

With some of the issues, students focused on the fact that numbers and mathematical representations simply help provide more information and greater accuracy. With regard to the dropout crisis, Lance stated that the charts communicate more information about how many and why youth drop out of school. Marcos also pointed out that knowing the actual number as opposed to an estimate of people dropping out is helpful so that people or programs trying to reach out to dropouts can have a clearer sense of what to expect. With other issues, mathematics was described as being essential to uncovering injustice. For example, the injustice in stop-and-frisk policing lies in the discrepancy between the ratio of number of stops to the total population of White, Black, and Latino people. Zohelia explained that without the numbers, "people won't get it, won't get the whole point of it."

Mathematics helped many of the students to realize the severity of issues of injustice. Nila pointed out that it was the numbers that provoked her interest in the topic of stop-and-frisk because they surprised her, and it was the numbers that made Zohelia realize, "It's more racist than I thought." Xavier said he had expected that Blacks were stopped disproportionately but had not anticipated that the numbers for Latinos, like himself, would also be "outrageous." Isaiah invoked mathematical comparisons during the interview, even citing the numbers discussed in class, to explain his newfound understanding of the unfairness of the outcomes of stop-and-frisk:

I knew everybody got stopped and frisked before, but to see that, what, 44% were White and 43% were Black, that at one point in 2009, what was it, like, 189,000, like that the people who got stopped and frisked was like 69,000 White, and the

numbers don't match up at all. I noticed, at first I thought, 'Oh, whatever, everybody gets stopped and frisked,' but then I noticed it has to be something racial or something behind the scenes that nobody knows about because the numbers don't add up. White people take up the majority, they're more populated than Blacks, something's not going right. So yeah, I mean you realize something and thanks to math, it happened, because without the math, I would have never really noticed.

While it is difficult to believe that Isaiah had no idea that the issue was racial before the class investigation, it is possible that having lived for so long in a predominantly Latino community, Isaiah had not spent much time comparing his experiences with those in a White community. His explanation that he "would have never really noticed" could be alluding to a general feeling of complacency with a situation for which he had no definitive evidence and a lack of space to consider and discuss it. Raul also drew on a mathematical argument to explain the source of his classmates' anger in terms of the wealth inequality issue; he cited numbers to show the discrepancy of a high percentage of wealth being owned by a small percentage of people while only a small amount of wealth was owned by "like millions of regular people." He punctuated his remark with the statement, "Wow, we're getting screwed," reflecting a sense that this information was revelatory. Raul also stated this sense more directly: "Like some of the stuff that you learn by doing the math you never know if you didn't do it. There was a couple of times when I left that class where I was like, wow, I didn't even know that."

Mathematics also played a validating role for many students, for whom the issue was close and personal in their lives, whether as victims or witnesses. Hector and Marcos said they were not surprised at learning the numbers behind stop-and-frisk because they had personal encounters with it. Examining the issues mathematically provided concrete and detailed evidence that confirmed what they knew from their

experiences and intuition. Hector explained having a feeling that Latinos and Blacks were being targeted, and through the mathematical investigation he saw these feelings substantiated. Marcos, who said he had multiple experiences being stopped without cause, said he was interested in learning about the actual numbers because knowing that the numbers are high would be more effective in calling attention to the issue. For Marcos, having numerical facts about the high rate of unjust stops was a way of turning his experience into a valid issue.

As a witness of stop-and-frisk policing on the news, Evelin felt a different sense of validation through mathematics. Evelin said she had noticed from watching the news that Latinos and Blacks were being targeted, but learning about stop-and-frisk in class was “a big difference, because the news, they don’t tell you anything.” According to Evelin, mathematics was the key to filling in the information that was not given: “[I]f you don’t know the percent and all that stuff, you’re just like clueless and stuff when the news come on.” For Evelin, mathematics played the role of uncovering information that she was not normally privy to, giving her a true sense of mastery over knowledge about the issue in spite of the lack of information in the news. Similarly, Nila said that mathematics could uncover untruthfulness. She explained her point by referring to the finding in class that calculating the percentage rather than number of times that a weapon was found from frisks debunked the idea that weapons were found more often on Blacks and Latinos than on Whites.

These reflections show that through the class, the students experienced mathematics as serving an essential role in relation to the real world. Although only Isaiah and Raul used mathematics to show how mathematics helped them to learn about

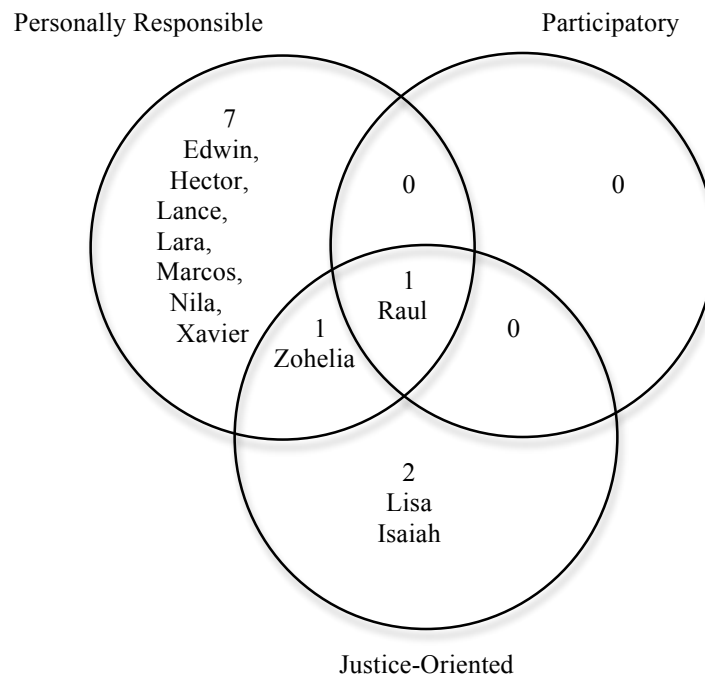
the social justice mathematics issues, other students articulated the important role of mathematics in learning about the world by relating how it affected their lives personally. These reflections reveal that at the LCLC, students felt a sense of power in knowing the mathematics to explain the issues, whether in terms of noticing the injustices through the evidence, validating personal intuitions about injustices, or empowering people with knowledge that is otherwise hidden or inaccessible. For the students at the LCLC, their experiences with social justice mathematics helped them to see that mathematics can play a more meaningful role in their lives aside from applying it to find numerical solutions to perform tasks in their daily lives.

### **Mathematics for Social Justice: Addressing Issues and Making Change**

Students' responses to addressing issues of social justice examined in the class provide insights into how their experiences learning about these issues contributed to their sense of empowerment as citizens. Unlike most of the issues that students brought up on their own during the interview (drugs, violence, and crime), the topics examined in the class were more specific and were framed as issues of injustice. The nature of the issues incited justice-oriented responses for several students, though a majority adopted personally responsible approaches toward the issues. Figure 10 shows the distribution of student responses to issues they learned in class.

*Personally responsible response.* In most cases, learning about issues of injustice was assimilated into students' existing ideas about the role of a citizen. With topics like bullying and the dropout crisis, the students' responses primarily had to do with changing individuals' personal decisions. Lara and Raul, the two students who had experienced the lessons on bullying, said that learning about the issue would influence people to not

be bullies, and Raul added that someone could also make change by telling others about what they learned in the class and influence their behavior. Hector and Marcos reflected on their own decisions to drop out of school, and they expressed regret and motivation to do better, which they attributed to participating in the class. For example, Marcos said that talking about what is going on in the world made him more aware of his role in making change, starting with changing himself by getting his GED. Other students like Lance and Edwin focused on the action of helping others to make responsible decisions. For both of these students, having a deeper understanding of the magnitude of the issue and the reasons why people drop out made them feel better equipped to connect with and help others who were either considering dropping out or who had dropped out.



*Figure 10.* Categorization of responses to address issues of social justice. (Not pictured: Bianca, Evelin, Felipe, Shaquan, Wendy, Wesley).



It was more difficult for students to imagine how the injustices of stop-and-frisk policing could be addressed. Employing a similar framework as with bullying and the dropout crisis would mean making change by either not committing unjust stops and frisks oneself, which does not make sense as none of the students were police officers, or influencing police officers to change their behavior. Zohelia did consider the latter idea, which resulted in her feeling powerless and, thereby, not responsible: “It's not on my hands, it's on the police hand. . . . I can't really do nothing, 'cause that's... if you're racist, I can't change you for being racist, it's on you. It depend on if you want to change or not.” Raul considered how a citizen could have a role by reporting unjust behavior so that police officers may be punished for their actions, but this also led to a sense of powerlessness. He concluded that punishing police officers would not make a difference because they would only receive ineffective consequences like temporary, paid suspensions. Raul’s suggestion was based on the assumption that reporting the behavior would even initiate action; but more notably, Raul’s focus on individual behavior was a missed opportunity to consider the role of a citizen to fight a system that would be so lenient.

Instead of focusing on addressing the injustices of stop-and-frisk policing by changing the behavior of police officers, students shifted their focus to how potential victims could avoid being stopped. Xavier focused on himself; he said that learning about stop-and-frisk helped him by motivating him to be at the LCLC program rather than out in the streets. Zohelia argued that more awareness about stop-and-frisk could encourage people to be more cautious when in public. Meanwhile, even while admitting that most of the people stopped turned out to be innocent, Nila said that youth should stay

in school rather than being out in the street and risking the potential of being arrested or even killed. Fixating on changing what youth have most control over resulted in Nila placing the blame on the victims.

*Participatory response.* There was only one participatory response from a student at the LCLC. Raul, in response to stop-and-frisk, ventured the idea that people could put up signs near schools admonishing students to go home if it is outside of certain hours. Raul compared these signs to “drug-free zone” signs, which suggests an action that is too large for one person to accomplish. At the same time, like Zohelia’s idea about encouraging more caution to the public, the idea focuses on strategies to reduce the effects of unjust stop-and-frisk practices by influencing the behavior of people rather than working to change the injustices themselves.

*Justice-oriented response.* Four students offered justice-oriented responses to issues. One of these students, Lisa, addressed the injustices behind issues around income inequality. Lisa, who had witnessed a rally from the Occupy movement, supported the actions of the protesters and suggested similar actions to voice injustices she saw in the tax system. She suggested that someone could go to the nation’s capital to start an organization or movement. Lisa was optimistic about her idea, arguing that the movement would gain momentum and force a response: “The states rebelling against the senators and what the senators are saying, and the states rebelling against the mayors and all the government officials and everything like that, they don’t got no choice but to do what the citizens are saying.” Still, she refrained from saying she would become involved herself, as she felt more people were needed to be effective.

Three other students articulated justice-oriented responses to injustices surrounding stop-and-frisk. One of these students was Zohelia, who had in the same interview declared that it is out of her control since it is police who must change, and then suggested encouraging people to be careful in public as a measure for abating its harm. When asked directly whether she felt that citizens could do anything to change the behavior of the police, Zohelia said that citizens could protest, “like they be doing on streets and things.” She continued, “Or probably talk to someone about... go to someone who works especially... and they can help you,” suggesting a lawyer. Zohelia’s recognition that there is unfairness and injustice in stop-and-frisk practices prompted her to brainstorm ideas to challenge it. Working from this idea, Zohelia presented a scenario in which she could see herself becoming involved. Zohelia, who had described her own role in effecting change as trying to influence others but doubting her own potential to be effective, declared that she would participate in standing up for someone she knew personally if that person was a victim of an unjust stop-and-frisk case, invoking her knowledge gained from class and her confidence from leading a presentation of the class’s findings:

Zohelia: Yeah, ‘cause I’ll tell them the percentage, and they’ll be more aware. Like the presentation, it helps.

Vivian: So you would make who more aware?

Zohelia: The people that... Let’s just say we doing a team to go up there, so I’ll show them. I’ll explain to them this is what’s going on, they’ll know what to do when they’re over there.

Zohelia was still hesitant to say she would speak out herself, and she presented a narrow circumstance of an individual instance of injustice that would prompt her to act, but

nonetheless she saw an important supporting role that she could play as an educator to empower others to act based on the knowledge she gained from class.

Raul, who had proposed personally responsible and even participatory responses to address the impact of stop-and-frisk, also hinted at a justice-oriented response. As he discussed the importance of learning about issues, Raul argued that this knowledge could be powerful in enacting action if it is spread to more people:

I think, say five people in class talk about this situation, then five other people talk about the situation, and you talk to the other five people that did it last, and then you talk about maybe we should do something about this, and they go, it goes into the community. Then the community start taking interest in it and then it goes to the police academy, then goes to the 25th district, 26th district... If there is enough people and your class started it all, then yeah, it can make a big difference.

This idea is an extension of previous ones about the community gathering to get something done, which he had described when he defined citizenship and discussed how a community might address violence. The difference is that in these previous examples, the action of the community was to address negative symptoms in the neighborhood—coming together to organize a cleanup and forming a collective network of calls to the police about witnessing crime. In this instance, although the action of the community and the district is unclear, Raul is referring to taking the issue to be resolved at the level from which it originates, not where it manifests.

Isaiah was the final student who talked about fighting injustice. Isaiah started off by reflecting on stop-and-frisk, confessing that although he had always known that racism existed, seeing the stop-and-frisk data “showed more” about what is going on in the world. He then broadened his reflection and made a more general but powerful

statement about the importance of knowledge about issues. He explained it in the following way:

Like say you had a gun, you had ammo right? You need these types of things, you need to know these types of things. You never know what's going to happen. Like I said, politicians, politics, everything, the government, you need to know these kinds of things. So we're hitting it in schools as these kids is growing up. If we're hitting these situations and they're learning about it every day, things that they have to go through and they might have to go through in the future, they already know about it, it'll lead them as better citizens as well, so I believe.

Prompted to elaborate further, Isaiah explained how he viewed his own role as a citizen:

Isaiah: I probably would have never voted [before], but I think you know as I said, we all have a... so it's the... about the stop-and-frisk, we can um, what do you call that, not strike but when you go against something...  
Vivian: Protest?  
Isaiah: Yeah, like you can protest. Now I can see that if a protest was to happen against the stop-and-frisk, I would actually go to the stop-and-frisk protest because it isn't right. So yeah.

Isaiah considered voting, but then stopped himself and shifted to protests as a response.

It is possible that he was going to say he would be more likely to participate in voting, but stopped short when realizing he was not sure about how voting would directly address the injustices of stop-and-frisk. Isaiah's response shows how a student, who had only been present for one class session about stop-and-frisk (the simulation activity) could be profoundly affected by learning about an important and meaningful injustice that impacted his community.

The social justice mathematics class exposed students to learning about real-world issues in their own communities in a focused way. The class did not focus on the prevalence of drugs, crime, and violence in the community but rather on specific issues of injustice. Doing so prompted more justice-oriented responses, especially in the case of issues where injustice was easily seen and taken up by the students. Still, the conceptions

of citizenship that students brought with them were strong. Even in responses to issues of injustice, students tended to gravitate towards personally responsible and participatory responses that led to reforming the victims rather than the causes of the injustices.

### **Learning from Reflections on Social Justice Mathematics Across Cases**

Looking across both cases, we learn that mathematics for social justice has the potential to empower youth as citizens, both by expanding their understanding of how mathematics relates to the world beyond functional uses and by equipping them with knowledge about issues in order to be able to fight for change. However, not all students experienced such empowerment. This section describes the possibilities and challenges of empowering youth as citizens through social justice mathematics.

### **The possibilities of social justice mathematics for empowering youth as citizens**

Experiencing social justice mathematics exposes students to mathematics in their lives beyond applications for functional and money-related purposes. Mathematics for social justice pushes students beyond fragmented conceptions of mathematics, which only position mathematics as something to apply to find answers, towards seeing mathematics as having complexity, purpose, and a connection to the real world that can move students towards more cohesive conceptions of mathematics. The students in this study across both settings did not show major shifts in their conceptions of mathematics in ways that made them articulate a new definition of mathematics as a result of their experiences, but they showed they were seeing mathematics as being more connected to the real world in how they talked about mathematics in relation to what they learned. At both settings, seeing the issue through numbers prompted students to reflect on their own knowledge and experiences with the issues in their lives. At Hewitt, students also

showed through how they discussed the issues of vacant lots that they were relying on mathematics and mathematical representations to make sense of the issue. At the LCLC, students spoke of how mathematics served a role in validating their own personal knowledge and experiences. Through their experiences with social justice mathematics, the message that the students were receiving is that mathematics is not only for performing functions as personally responsible citizens but also for understanding issues affecting their communities in order to be able to change them.

Social justice mathematics also has the potential to empower youth as citizens by providing them with knowledge about issues of injustice so that they may enact or fight for change. A couple of students, namely Ferrell at Hewitt and Isaiah at the LCLC, verbalized a new, social purpose of mathematics: to make change in the world. Students were empowered to see that mathematics is not just as a tool to apply but, as Isaiah called it, a “gun” or “ammo,” which concurs with the language of Gutstein (2012) who called mathematics a “weapon in the struggle.” Other students did not articulate this role of mathematics but referred to what they learned in class as they described ways they could address the injustice. In both settings, students who had not previously suggested justice-oriented responses to issues their community were now proposing them. In both cases, the students referred to the knowledge or even “the papers” from what they learned as evidence that they could use to convince others to address the issues. This was significant for the students at Hewitt, who had in their initial interviews expressed reliance but distrust in authorities like the government or law enforcement officials, and the students at the LCLC, who tended to strongly limit their reliance to themselves. Empowered with more knowledge, the students felt citizens had strong evidence to be

able to voice their concerns about the issues in a more effective way. In fact, in both settings, even when students did not propose justice-oriented ways to address the issues, they expressed a sense of empowerment through having gained knowledge that they felt was important.

### **The challenges of social justice mathematics for empowering youth as citizens**

Despite the potential presented in the previous section, the work also revealed challenges in empowering youth as citizens across both sites. Personal responsible responses to address the issues were still dominant for the students at both schools, which shows the students were limited in how they engaged with the issues. At Hewitt, many of the students reframed the issue in terms of the physical state of the vacant lots and focused on actions like cleaning and planting gardens to make them more beautiful and less dangerous. The message of personal responsibility that Hewitt and Diana instilled in the students may have served as a contributing factor. In the journal writing components of the citizenship project at Hewitt, one of the prompts asked students to come up with negative and positive “possibilities that could happen” in the vacant lots. Students may have latched onto these ideas rather than thinking further about the injustices of the disparity in the number of vacant lots in the first place. However, even at the LCLC, students focused primarily on personally responsible actions in response to the issues, such as not bullying, not dropping out of school, and even staying away from the streets in order to avoid being stopped unjustly by the police. At the LCLC, where Olivia was engaging her students in readings about the injustices behind the issues and leading discussions in which she pointed out these injustices, students’ responses still gravitated to personally responsible solutions.



A possible explanation is that students still did not feel that justice-oriented options would be effective, stemming from distrust of authorities to respond, so the focus may have been on what individual citizens can do. In addition, the dearth of justice-oriented responses could be pointing to a weakness in the curriculum in that there were not enough explicit discussions about the policies behind these issues. In the classes, ways to respond to the injustices were not discussed, so the students had to come up with ideas themselves. Finally, it could also reflect students' strong internalization of citizenship as personal responsibility. Whatever the reason or reasons may be, the concern with a focus on personally responsible ways to respond is that it can lead to blaming those in the community. At Hewitt, some students blamed people's laziness for the unkempt vacant lots, and at the LCLC some students insinuated that youth are partially responsible for being stopped because they should be doing something productive instead, like being at school. Teaching students mathematics for social justice can therefore be educative for students but without clear framing, more sustained efforts, and greater opportunities to delve deeper into the issues and the causes and policies behind them, it can be superficial and in some ways even perpetuate unproductive attitudes towards issues of injustice.

## **CHAPTER 7: CONCLUSION**

### **Introduction**

This study offered an analysis of the relationship between youth's conceptions of citizenship and their conceptions of mathematics in order to understand the role that mathematics can play in the development of youth as citizens. The study also explored the possibilities and challenges of a social justice mathematics approach in influencing students' conceptions. There were three main research questions I addressed in this study: 1) What are youth's conceptions about what it means to be a citizen? 2) What are youth's conceptions about mathematics and their conceptions about the role of mathematics in citizenship? 3) How can a social justice mathematics approach influence students' conceptions of mathematics and citizenship? I answered each of these questions by analyzing interviews with students from two research settings, a middle-school mathematics class in a public school in a low-income neighborhood serving primarily Black youth, and a mathematics class at an alternative educational program for out-of-school youth obtaining their GED serving primarily a low-income Latino population. I addressed each question with respect to each of these settings then looked across the findings to propose implications about what citizenship means to youth with different experiences and backgrounds. In this final chapter, I present my key findings and implications about my findings together as part of the larger discussion about the relationship between mathematics education and the development of youth as citizens. I conclude the chapter by explaining the limitations of my study and proposing suggestions for future work.

## **Key Findings and Implications**

The findings and implications of this study can be summarized by the following four statements:

1. Citizenship education is already occurring, including through mathematics education.
2. Dominant conceptions of citizenship exclude youth from engaging as citizens who are agents of change.
3. We need to rethink and reclaim citizenship education in school to empower youth, particularly youth of color.
4. Mathematics for social justice presents promising possibilities for mathematics education to play a role in citizenship education by empowering youth as agents of change.

This section elaborates on and presents a discussion of each of these statements.

### **Citizenship Education As Already Occurring**

The findings from my study show that citizenship education for youth occurs regardless of having an explicit curriculum or program to teach youth about citizenship. I used Westheimer and Kahne (2004)'s framework to analyze students' conceptions of citizenship as showing evidence of personally responsible, participatory, or justice-oriented citizenship, with the possibility of cutting across multiple categories. I found that students at both Hewitt and at the LCLC articulate a coherent vision for what it means to be a citizen. Furthermore, most of the students articulate the same vision: a personally responsible conception of citizenship. Students at both settings primarily associated the idea of citizenship as being responsible by obeying laws, rules, and

abstaining from deviant behaviors, as well as by working hard and eventually attaining gainful employment that enables one to pay one's bills and taxes. The association of citizenship to personal responsibility was also reflected in students' discussions about issues in their communities and how to address them. Across both research sites, the issues that were most salient to almost every student participant included issues related to drugs, violence, or crime in their communities. The selection of these issues reflects a view of problems through the lens of personal responsibility. As students discussed how these issues could be addressed, most gave suggestions aligning with personally responsible citizenship, focusing on how individuals should make better choices or influence others to do so. My study does not examine how it is that students learned about citizenship as personal responsibility; however, the findings indicate that students are learning a particular idea about what it means to be a citizen, whether from their experiences in school, at home, the media, popular rhetoric about citizenship, or a combination of these sources.

My study does show mathematics education as one source contributing to youth's conceptions of citizenship as personal responsibility. As with my findings on citizenship, my study does not examine the mathematics education that students had received; rather, I examine students' conceptions of mathematics to gain insight into what they have learned about mathematics throughout their lives. I analyzed students' conceptions of mathematics as fragmented or cohesive (Crawford et al., 1994), and for cohesive conceptions further characterized the conceptions as reflecting a conception of mathematics as modeling or as an abstract system (Petocz et al., 2007). I also analyzed students' ideas about the relationship between mathematics and the real world. What I

found is that students' conceptions of mathematics supported students in fulfilling personally responsible citizenship. Most of the students at both Hewitt and the LCLC exhibited fragmented conceptions of mathematics, defining mathematics as a collection of procedures and definitions involving numbers and variables. Such conceptions of mathematics limit the relationship between mathematics and the real world to applications of elements from the collection in order to find answers to problems. This translated into students primarily giving examples of mathematics playing a role in calculations with money, performing daily functional tasks (i.e., telling time, measuring ingredients for cooking), and use in possible future careers, especially careers involving money (i.e., cashier, bank teller). In other words, most of the students had learned that the purpose of learning mathematics is to serve functional literacy (Apple, 1992). More specifically, the overwhelming association of mathematics with money (including some students who said dealing with money was its sole useful application) and for careers positions mathematics as supporting students as economic citizens but not political ones.

We learn about an additional dimension of students' conceptions of mathematics by examining how they see the mathematics they learn in school relating to the real world. At both research sites, but especially at the LCLC, a majority of the students viewed the mathematics they learned at school as distinct from the mathematics in the real world. The purposes that students gave for learning mathematics in school despite this distinction often had to do with the gate-keeping function of mathematics. Students at Hewitt and the LCLC said that learning mathematics is important because it would help them to advance academically and attain the credentials to obtain employment. Others upheld mathematics knowledge for the sake of knowledge. This latter stance

seems to reject the idea that learning school mathematics only serves a credentialing purpose, but by accepting mathematical knowledge without being critical, students with this view were reinforcing and validating the system used for gate-keeping. In the end, all of these students were accepting a role of mathematics as a way to fulfill one's responsibility as a personally responsible citizen, whether as a pathway towards obtaining credentials or the knowledge that society had deemed valuable for citizens to attain. This function of mathematics was not part of the explicit curriculum that students experienced, but rather part of the "hidden curriculum" (Skovsmose, 1990), which delivers a message about how citizens should behave via the traditions, rituals, and structures of mathematics instruction.

### **Citizenship As Exclusionary**

Preparing youth for only personally responsible citizenship results in excluding youth from participating fully as democratic and critical citizens. A personally responsible conception of citizenship in and of itself is not problematic. Having a strong sense of one's responsibilities and aspirations for oneself and developing kindness and compassion for others are healthy and admirable attributes that all people should strive toward. However, focusing solely on personal responsibility is not sufficient for one to be an agent of change in one's community or society. Because a personally responsible view takes the perspective that people's choices are the root causes of problems in society, it can empower individuals to make positive choices for themselves but result in feelings of powerlessness when it comes to broad-scale societal change or change in one's community. At Hewitt and at the LCLC, responses to issues in the community categorized as personally responsible were often about changing or maintaining one's

own behavior (i.e., not committing crimes oneself, not littering) or about trying to convince others to do so, something that students expressed would be difficult since individuals have little control over the choices of others.

Even participatory responses, however, often left students feeling powerless to make change. While suggestions such as creating programs, organizing events, distributing flyers, and even voicing the problems to authorities to address issues (i.e., through better policing) are ways in which citizens could take action beyond making individual change, these suggestions, too, ultimately serve as organized ways to address the behaviors of individuals. For example, creating a program for youth to talk about issues they struggle with deals with the behaviors and experiences of youth rather than the causes of the issues, and writing a letter to the mayor to do something about crime is a way to mobilize authorities to help stop the criminal behavior of people. Ultimately, the participatory responses students suggested also rely on changing or controlling individuals' behaviors. Such approaches focus on changing symptoms rather than dealing with root causes of the issues, and they can lead to unproductively blaming those whose behaviors are seen to be the problem and in need of being changed or controlled. For some of the students at the LCLC, who had been arrested in the past, this includes themselves.

Perhaps because of their sense of powerlessness to make change beyond the individual as personally responsible individuals, at Hewitt, a majority of the students relied on external sources of authority like law enforcement officers and government leaders to deal with issues, even though the students simultaneously displayed distrust in these authorities to work on behalf of the community's needs and interests. At the

LCLC, only a few students mentioned these authorities, and they also expressed distrust. A lack of faith in the power of personally responsible (and even participatory) approaches to address issues in the community or society, coupled with a distrust of government and law enforcement officials to be doing the work, leaves youth with only a lack of hope for any kind of change in the conditions of their lives outside of their own individual choices.

The dominance of personally responsible conceptions of citizenship disempowers students from being agents of change. In addition, another dominant notion of citizenship also sends a message of citizenship as exclusion to youth; at least some students at both settings associated citizenship with the legal definition of citizenship. This was especially evident at the LCLC, where many of the students' references to legal citizenship resisted notions of legality in citizenship. A possible factor for this type of response from the students at the LCLC is that most of these students were from Latino communities, where the issue of citizenship in legal terms is more relevant and usually discussed in terms of exclusion. Thus, for the students at the LCLC, citizenship was associated with exclusion from belonging in the polity, and being limited to a personally responsible conception of citizenship only added to that exclusion by suppressing their abilities as members of that polity to shape society.

### **Rethinking Citizenship Education in Schools**

As educators, we need to rethink citizenship education if we want to empower youth, especially for youth of color like the ones in this study. First, we need to reclaim the word "citizenship." Rather than allowing a definition of citizenship that is related to legal terms take up so much space in the discussion of what it means to be a citizen and thereby allow it to become the dominant association with citizenship in people's minds,



educators should be explicit about defining citizenship in terms of belonging to the democratic polity and what that means about one's role in it. Furthermore, we need to be conscious of the dominance of personally responsible conceptions of citizenship that are taught both explicitly and implicitly through our schools and classrooms, as part of the effort to challenge and present alternative conceptions of citizenship to students.

Second, as Rubin (2007) advocated, citizenship education needs to go beyond traditional notions of what it means to learn about citizenship, such as voting and having knowledge of government. I am not suggesting that marginalized youth cannot benefit from engaging in these ways, but given the complicated relationships that their communities have with authorities such as government and law enforcement, engaging in official, structured ways cannot be the only options. Instead, educators should turn to the youth and their communities as resources. We learn about the potential for students and their communities to serve as resources by comparing student conceptions of citizenship at the LCLC to those at Hewitt. At the LCLC, students had a greater diversity of conceptions and displayed more personally meaningful ideas compared with students at Hewitt. For the students at the LCLC, citizenship was enmeshed with their personal life goals, their strong ties to their communities, and their identification with humanity's struggles for freedom and equality. It is possible that the conceptions of the students at the LCLC reflect growth, maturation, and a stronger sense of self through their greater experiences in life outside of school. This would indicate that citizenship education continues to take place as youth grow as individuals and as member of their community and society, and that youth's lives and communities outside of school can be essential resources for educating youth for citizenship.

Educating youth towards justice-oriented citizenship is promising for the youth in this study, who are often living at the center of multiple injustices as low-income youth of color. Studying and uncovering injustices in their world can be a powerful way to connect citizenship education to their lives and communities. Students' naming of issues related to drugs, violence, and crime as the issues that they would like to be different reflects the salience of these issues in students' perceptions of their communities. This does not mean necessarily that students had negative views of their lives and communities—in fact, many described positive aspects like their strong community bonds—but that when they did think about problems in their community they gravitated towards naming negative symptoms that are difficult to address and often result in blaming rather than problem-solving. Shifting the focus to specific issues of injustice creates an opportunity to shift youth's perspectives about their communities towards uncovering injustices, thereby opening up possibilities to think about how to make meaningful, systemic change. Engaging students in fighting against rather than conforming to the norms established by dominant structures and powers presents a promising possibility to redefine citizenship education.

Public schools are ideal institutions for citizenship education to take place. Schools should not just be places to prepare students for citizenship; they should engage students in enacting citizenship by actively engaging youth in learning about issues of injustice in their community and taking actions to address them. Such experiences might offer an important opportunity to empower youth before they are thrust into adulthood and adult responsibilities. Many of the youth at Hewitt expressed that they felt they were too young to engage in addressing issues; despite their greater maturity, independence,

and more meaningful definitions of citizenship, the students at the LCLC were just as if not more likely to say that they did not envision a role for themselves as agents of change, often citing that they needed to focus on themselves. The case of Wendy, who participated in an in-school program for youth organizing and advocacy, exemplifies the potential for schools to educate students for citizenship and have a lasting impact by providing students with experiences examining real-world issues of injustice and taking collective action. Regardless of whether she might engage in civic actions in the future, Wendy had a complex understanding of citizenship and sense of agency as a citizen. Like Wendy, I am not advocating that all youth must become actively and politically engaged to be considered good citizens; rather, what is important is that youth are equipped with the knowledge and sense that they have the power to participate in meaningful ways towards making change in their world.

Another reason that public schools are important sites for citizenship education is that public schools are also a type of community organization, a place for people to gather to serve the public good. An additional reason that students Hewitt and the LCLC cited for feeling powerless to make change, including some students who held justice-oriented conceptions of citizenship or suggested justice-oriented responses to issues in their community, was that they felt that they could not effect change alone; they needed more people to stand with them. Schools have the potential to provide that community of people that these students were seeking.

### **The Possibilities of Social Justice Mathematics for Citizenship Education**

Social justice mathematics has the potential to educate youth towards justice-oriented citizenship in schools. Although mathematics may seem like an unlikely match

for citizenship education compared to subjects like social studies, I argue that mathematics provides a unique avenue for empowering youth as citizens. In my study, learning about injustice through mathematics provided the students at Hewitt and the LCLC with a sense of power. At both sites, there were students who responded to examining issues about injustice in their community with justice-oriented responses, unlike their responses to issues like cleaning their neighborhoods. The role that mathematics played was that in these responses, students often referred to the knowledge they gained from learning the mathematics of these issues as a key component. At Hewitt, where the students had expressed reliance on but distrust of the government to act, being equipped with the mathematics they learned gave them a sense of hope that they may be able to make convincing enough cases to incite responses from government officials. In other words, mathematics played a legitimizing role that strengthened students' arguments and gave them a sense that they had power.

Not only does mathematics provide a legitimizing force for backing youth's actions, it also serves to legitimize their experiences. At Hewitt and at the LCLC, the students often referred to their knowledge and experiences about the issues, whether about the large presence of vacant lots in their communities or the racial profiling in stop-and-frisk practices. By learning about these issues through mathematics, the students felt their opinions were legitimized and often strengthened. Even without further inciting actions to address these issues, the act of legitimizing can be a significant source of empowerment for youth whose lives and experiences are often cast as not being relevant to learning in schools. The legitimizing power of mathematics can communicate to the

youth that their knowledge and lives are also valuable, and in turn that schools and citizenship also belong to them.

In addition, through social justice mathematics, there is also the potential to change the role of mathematics itself in shaping students' conceptions of citizenship. Rather than positioning mathematics as solely being useful for functional and economic citizenship, engaging youth with mathematics for examining issues of injustice in their lives can teach youth about new purposes of mathematics that relate to their lives as citizens. This can especially be impactful for youth who may feel excluded even from opportunities as economic citizens. While many of the students at Hewitt were still hopeful and unrestrained in their ideas about possible future careers, the students at the LCLC were more realistic and practical. This more realistic sense of their futures translated into more skeptical views about the relevance of learning mathematics in their lives. Many of the students at Hewitt expressed a belief that although they may not understand why they are learning some of the mathematics in school, it is important to learn because it may prove useful in the future. At the LCLC, most of the students had been disabused of this notion, especially as they had distanced themselves from possibilities like becoming a scientist. For the students at the LCLC, the importance of mathematics was limited to basic functional purposes and credentialing purposes. By pursuing mathematics for social justice, the relevance of learning mathematics beyond basic arithmetic is not limited to those pursuing specific careers; mathematics becomes important for all youth as democratic citizens.

Joining mathematics with citizenship in an explicit way can further educational goals in both. It is important to have both components together, as they drive each other.

Mathematics for social justice can encourage more cohesive conceptions of mathematics, which in turn enable mathematical approaches to examining issues of social justice. In my study, engaging the students at Hewitt and the LCLC in examining issues through mathematics resulted in some students having new perspectives about mathematics that reflected elements of cohesive conceptions of mathematics. At Hewitt, students also demonstrated that they were able to draw on mathematics and mathematical representations to make sense of the issue of vacant lots; regardless of whether they were yet aware of it, they were engaging in modeling with mathematics.

Moving towards a modeling conception of mathematics can help youth see more than functional uses of mathematics. At both settings, students who demonstrated more cohesive conceptions of mathematics usually gave different examples of how mathematics is relevant in the real world from those of their peers. For example, students with cohesive conceptions named understanding international currency, the economy, and city budgeting as contexts in which mathematics is central. Although still in the realm of tying mathematics with money, these examples position mathematics not just as useful for calculating monetary transactions but for understanding how systems work. Only focusing on building cohesive conceptions of mathematics is insufficient, however. Wesley at the LCLC, who came closest to having a cohesive conception of mathematics, did not see how mathematics related to citizenship. Conversely, Wendy was empowered civically through her participation in a youth organizing and advocacy program, and as a result, she was able to recognize the important role mathematics plays in society despite expressing difficulty with mathematics in school. Comparing Wendy and Wesley shows that explicit social justice goals are essential; without a meaningful contexts and purposes

with which to engage mathematically, the potential for mathematical empowerment as citizens can be lost.

Mathematics for social justice repositions mathematics as a means towards critically examining and understanding how the world works and as a source of power to make change in the world. By advocating for teaching mathematics for social justice to empower youth as citizens, I do not imply that all mathematics lessons should be explicitly political. However, it is important to understand that mathematics lessons are already inherently political. Understanding this function of mathematics education is essential in considering the role for mathematics for social justice in the classroom.

### **Limitations and Future Work**

There are several limitations of this study that would benefit from being addressed in future work. First, this is an interview study with young people, and conceptions of citizenship and mathematics are complex. Some students expressed difficulty with articulating their ideas, especially the students at Hewitt. However, having difficulty with articulating one's definition of citizenship and mathematics does not necessarily indicate that their ideas were less developed. In addition, while relying on the students to provide their own definitions allowed them to freely express their associations and ideas, it does not mean that their ideas were limited to what they verbalized. Asking students follow-up questions (i.e., how they would address issues in their community, why they think mathematics is important) was helpful, but better strategies for drawing out conceptions could provide fuller insights about students' conceptions. For example, developing tasks in which the participants react to scenarios or other prompts could help them engage with the ideas indirectly and more comfortably.

The curriculum that the teachers and I developed also presented a set of limitations. Curriculum is a human product, subject to human variances, especially when there are different people involved in the creation of that product. Writing the curriculum with each of the teachers was a different experience because of the influence of the teachers' personal agendas as well as the limitations and structural factors of their institutional settings. As stated in Chapter 3, teachers' conceptions of citizenship and mathematics, their intentions in planning the curriculum, and the ways they delivered it in their classroom influence how students experience the curriculum (Stein, Remillard, & Smith, 2007). Follow-up analyses focusing on these aspects of the data would supplement the findings presented here.

In addition, there are multiple adjustments that could have made each of those curricular units better, encouraged students to probe deeper, and made stronger connections to justice and how to address injustice. The curricula that the teachers and I developed did not focus sufficiently on having students consider the policies that underlie the issues of injustice examined. Neither were there sufficient discussions of different types of actions that students could take in response. These two ideas—the policies and actions—were largely left to the students to connect. Finally, students' experiences with social justice mathematics were short-lived in both settings. At Hewitt, the students experienced 10 sessions, and at the LCLC students' volatile enrollment in the project limited their exposure to social justice mathematics lessons. Understanding how including policies and actions more prominently in the curriculum along with more sustained work with social justice mathematics can affect students' conceptions would



provide a fuller understanding of the possibilities and challenges of social justice mathematics to empower youth as citizens.

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